Snohomish Estuary Wetland Integration Plan

April 1997

City of Everett
Environmental Protection Agency
Puget Sound Water Quality Authority
Washington State Department of Ecology

Snohomish Estuary Wetlands Integration Plan

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Prepared by:

City of Everett
Department of Planning and Community Development

Paul Roberts, Director

Project Team

City of Everett
Department of Planning and Community Development
Stephen Stanley, Project Manager
Roland Behee, Geographic Information System Analyst
Becky Herbig, Wildlife Biologist
Dave Koenig, Manager, Long Range Planning and Community Development
Bob Landles, Manager, Land Use Planning
Jan Meston, Plan Production

Washington State Department of Ecology
Tom Hruby, Wetland Ecologist
Rick Huey, Environmental Scientist
Joanne Polayes-Wien, Environmental Scientist
Gail Colburn, Environmental Scientist

Environmental Protection Agency, Region 10
Duane Karna, Fisheries Biologist
Linda Storm, Environmental Protection Specialist

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Appendices: **The following appendices are included in this plan:**

The following appendices are available separately upon request:

Introduction

The Snohomish Estuary Wetland Integration Plan (SEWIP) is a proposal to integrate the wetland regulatory frameworks of federal, state and local agencies into one process on the basis of an agreed-upon plan. The products and outcomes of this effort are a scientifically based inventory of the functions and values of study area wetlands and a framework, agreed upon by all the regulatory agencies, for expediting review of development proposals through the federal, state, and local permit processes.

If approved by the Corps of Engineers and adopted by the Everett City Council, SEWIP will provide an alternative "expedited" development review procedure. **SEWIP is not intended to replace the existing permit review process of the regulatory agencies. Rather, SEWIP is intended to provide an alternative which, when applied, will provide substantial savings of time and costs associated with development in and around the estuary.** The SEWIP program may also provide a basis for establishing and funding mitigation and restoration efforts in the estuary rather than paying for studies with uncertain outcomes.

The SEWIP proposal is comprised of five basic elements. These elements have been prepared with the support and involvement of the resource agencies responsible for regulating the wetlands, shorelines and wildlife resources. These basic elements are as follows:

1. Inventory and assessment of wetland resources quantifying the performance of wetland functions;

2. Identification of areas where development can occur without significant impact on the estuary;

3. Listing of enhancement and restoration sites and specific restoration actions;

4. Wetland compensation policies and replacement ratio formulas and requirements for monitoring and mitigation bonding; and

5. Recommended management guidance to local governments for the future drafting of shoreline master plans, GMA plans, and sensitive areas ordinances for the estuary.

SEWIP will now undergo an alternatives analysis as required by the 404 b(1) guidelines of the Clean Water Act. The Corps of Engineers will participate in this analysis and will consider whether to provide a regional permit or letter of permission to grant limited approval to SEWIP. Under an expedited SEWIP procedure, local governments would issue permits for some types of wetland alteration within the identified "development footprint" of this plan and allow restoration actions within specified areas of the Estuary. Alterations would only be permitted if conducted within the conditions of the overall permit issued by the Corps of Engineers and consistent with policies of this Plan. Projects which occur outside the development footprint or do not follow the restoration plans set forth in Chapter 5 of this document will not be eligible for

the expedited permit process, but may proceed through the COE “individual permit” process just as they do today, and a Section 401 Clean Water Certification from the Department of Ecology will be required.

The Plan has been funded by the Department of Ecology and the Environmental Protection Agency (EPA) as part of the State Wetland Integration Strategy (SWIS). It covered 11,518 acres of the Snohomish Estuary located in the west-central portion of Snohomish County (see Figures 1 and 2). Starting south, the study area extends from Woods Creek in the Marshland District (approximately one mile south of Jackknife Bridge), north to the tidal wetlands of Quilceda Creek. In preparing the plan, the City of Everett led a core team of wetland experts from Snohomish County, the State Department of Ecology, State Fish and Wildlife Department and the Environmental Protection Agency. As a result of this planning effort, the permit process within the Estuary will become more predictable in terms of where development should be permitted, how much and what type of compensation will be required, and the specific location of required compensation. This can provide for a substantial savings in time and money relative to the current process for projects which are consistent with SEWIP.

Description of SEWIP Contents

The Draft SEWIP document is organized into five chapters. These chapters present a "landscape analysis" of the Estuary ecosystem based on "rapid bioassessment" of 367 wetland complexes within the Estuary. The final product is a scientifically based management plan for the Estuary which balances preservation, restoration/enhancement, continuation of existing beneficial economic uses, and expansion of beneficial economic uses in areas of wetlands with lower performance of wetland functions.

A brief summary of the contents of this plan is provided below.

Chapter 1: Description of Process and Methods. Chapter 1 outlines the steps in developing the plan, including: the methods for conducting the mapping and inventory of the Estuary; developing and applying the Habitat Assessment Model; identifying the development footprint and restoration and enhancement sites; developing the specific restoration and enhancement actions for each restoration and enhancement site; and calculating the development debits and restoration/enhancement credits in the Estuary. Two advisory committees were involved in this process, the Snohomish Estuary Technical Advisory Committee (SETAC), and the User Advisory Group. Appendix A presents the agendas and minutes from both groups.

Chapter 2: Compensation Policies. Chapter 2 contains all of the compensation policies developed by SETAC for the Estuary.

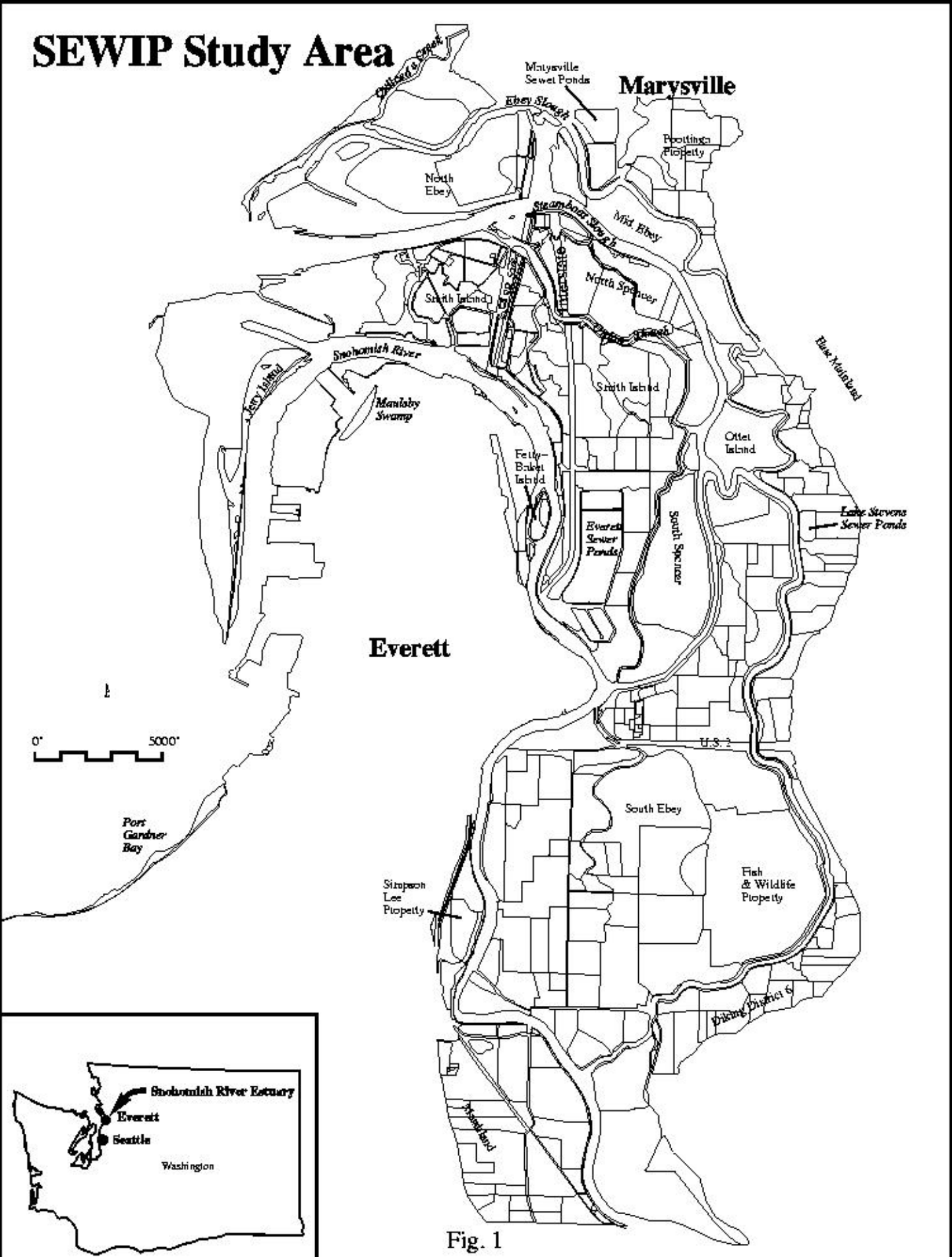
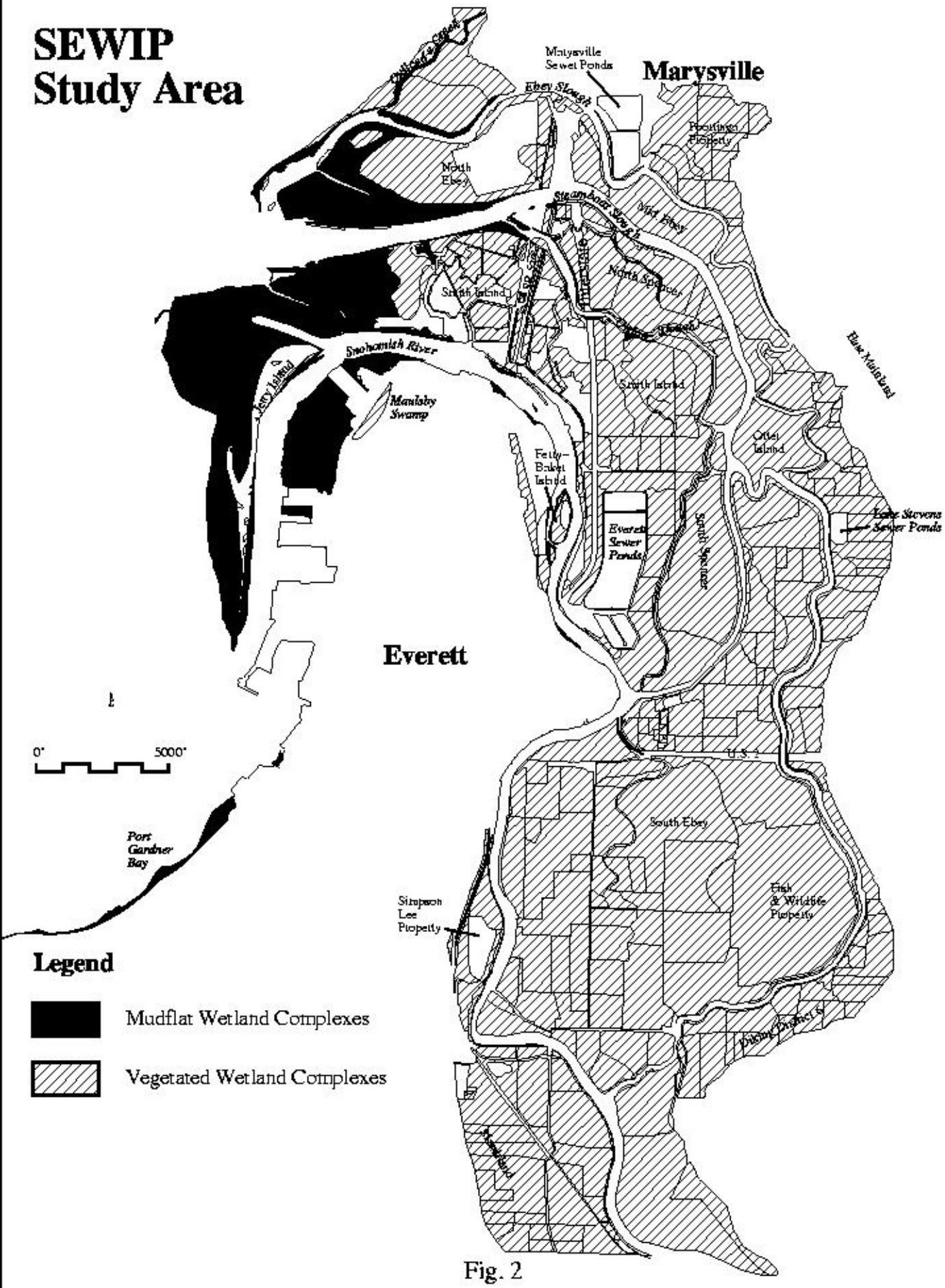

SEWIP Study Area
Marysville
Everett
Marysville Sewer Ponds
Ebey Slough
Steamboat Slough
Union Slough
Snohomish River
Smith Island
North Ebey
Mid Ebey
North Spencer
South Spencer
Jetty Island
Manilaby Swamp
Ferry-Baker Island
Everett Sewer Ponds
Ottet Island
Lake Stevens Sewer Ponds
Pootinga Property
South Ebey
Fish & Wildlife Property
Simpson Lee Property
Port Gardner Bay
U.S. 2
Pilchuck River
Ebey Slough
0'
5000'
Snohomish River Estuary
Everett
Seattle
Washington

Fig. 1


SEWIP
Study Area
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Lake Stevens Sewer Ponds
Otter Island
South Spencer
Base Monument
Marysville Sewer Ponds
Frontinger Property
Simpson Lee Property
Fish & Wildlife Property
Port Gardner Bay
U.S. 2
0'
5000'
Legend
Mudflat Wetland Complexes
Vegetated Wetland Complexes

Fig. 2

Chapter 3: Natural Resources of the Estuary. Chapter 3 describes the existing biological and physical Estuary resources including: plants, fish, invertebrates (including shellfish) and wildlife.

- Introduction - Description of Physical Environment and Ecological Management Units Based on Hydrogeomorphic Classes. Describes the Estuary in terms of its salinity, tidal, and sediment characteristics and divides Estuary into six ecological management units.

- Habitat Inventory for the Study Area. Outlines the modified Cowardin System for identifying Estuary vegetation types and provides an overall description of the vegetation communities and plant species found within them. The individual field inventories for 367 wetland complexes mapped within the Estuary are contained in seven separate volumes at the City of Everett, Department of Planning and Community Development. Examples of the assessment inventory sheets and an actual inventory are presented in Appendix B. A comprehensive list of plants observed in the Estuary is presented in Appendix K.

- Non-Vegetated Wetlands. Describes the types of mudflats (non-vegetated wetlands) assessed within the Estuary.

- Fish Resources. Describes fishery resources within the Estuary based on existing surveys conducted by the State, the Tulalip Tribes and the Port of Everett.

- Invertebrate Resources. Describes shellfish resources within the Estuary based on surveys conducted by the State, Tulalip Tribes and the Port of Everett.

- Wildlife Resources. Describes the wildlife resources within the Estuary based on the Priority Habitat and Species maps and wildlife observations by State, County and City staff, Tulalip Tribes; and private environmental organizations (Pilchuck Audubon) and individuals. Appendix G, available as a separate document, contains a detailed wildlife analysis based on existing information.

Chapter 4: Analysis of Data, Ranking of Wetlands and Identification of Wetland Categories. This chapter contains the study area GIS maps depicting: (a) the location of all 367 wetland complexes; (b) ranking of the wetland complexes by their calculated scores on a scale of 1 to 100 for three main functional attributes (Wildlife, Water Quality Improvement, & Social Significance); and (c) classification of wetland complexes into one of three categories based on a combination of the Water Quality/Wildlife Attributes and a separate wetland classification for each of the Social Significance Attribute functions. It should be noted that the wildlife function includes fish, bird, mammal, invertebrate and herptile habitat.

Chapter 5: Management Plan. Chapter 5 presents: (a) the overall management goals; (b) the restoration and enhancement goals; (c) the location, type and ranking of proposed restoration and enhancement for the Estuary; (d) the specific restoration/enhancement actions for each restoration site (Table 5.3); (e) the location of the development footprint; and (f) the compensation ratios.

Relationship to Other Plans

The SEWIP Management Plan (Chapter 5) provides an alternative management plan and coordinated approach to the regulation of Estuary wetlands within the City of Everett and eventually within Snohomish County. Presently, numerous state and federal laws regulate wetlands within the Estuary, often resulting in conflicts due to the different goals of the individual laws. The following discussion reviews laws and implementing wetlands regulations within the City, the type of regulatory conflicts that are present, and how this plan will address those conflicts.

Existing Environmental Regulation

The City's Environmentally Sensitive Areas (ESAs) are regulated by a series of federal, state, and local environmental laws, ranging from the Growth Management Act (GMA) and State Environmental Policy Act (SEPA) to the Clean Water Act (Section 404-Federal). While these laws require the development of planning tools essential to the protection of significant wetland resources, they do not provide for a comprehensive and coordinated management plan to protect, enhance and restore the "functions and values" of the City's wetland ecosystem. Provided below is a description of the requirements of the individual regulations and the areas in which conflicts presently occur or additional coordination and planning is necessary.

Growth Management Act (GMA). The Growth Management Act requires the City to protect critical areas and use best available science as a standard of protection. The City has mapped and inventoried a majority of wetlands within the city limits. The inventoried wetlands are based upon National Wetland Inventory Maps and City delineations of additional smaller wetland areas (including delineations submitted to the City by consultants). These wetlands maps have been stored digitally within the City's Computer Aided Design Geographic Information System (CAD and GIS) mapping system. This GIS mapping has now been updated with the 367 wetland complexes mapped and studied under the SEWIP study. The Growth Management Act encourages the concentration of development and economic growth within existing developed areas in conjunction with protection of critical resource areas. Because the Growth Management Act takes a watershed approach to planning for future development, the watershed-based SEWIP document is consistent with the main provisions of the Act.

State Environmental Policy Act (SEPA). The City has an adopted SEPA ordinance which requires analysis of impacts to sensitive habitat areas and the provision of measures to mitigate identified impacts.

Protection of ESAs is accomplished both through mitigation requirements imposed during the SEPA development review and through implementation of the requirements of Section 37 of the Zoning Code. However, SEPA does not effectively regulate cumulative impacts to wetlands and ecosystems. Because SEPA mitigation requirements are imposed on a site-by-site basis during development review, SEPA does not facilitate a comprehensive ecosystem-wide management program.

A comprehensive environmental analysis will be completed during the next phase of the SEWIP study and will address the cumulative environmental impact of the management plan. For

SEWIP to be accepted and approved by the Corps of Engineers and EPA, the plan must demonstrate that cumulative environmental impacts are avoided or minimized and that the overall environmental quality of the Estuary will be improved. Otherwise, permit applications will not be expedited, but rather subjected to the review process as it currently exists.

Shoreline Management Act. Regulatory provisions of the state's Shoreline Management Act and the City's Shoreline Master Program may apply to wetlands determined to be "prior converted" by the U.S. Natural Resources Conservation Service within the 100-year floodplain of the Snohomish River. The City is in the process of preparing and adopting a new Shoreline Master Program (SMP) and is coordinating this master program with other planning elements under the GMA. Completion of the new SMP is expected in 1997. The SMP contains a comprehensive set of policies and land use designations designed to protect the highest value City wetlands (mapped in the inventory), and to provide offsite mitigation for the development of lower quality wetlands within urban zones. The SMP already contains the essential elements of the Wetlands Integration Plan including: (a) using a watershed planning approach; (b) improving the overall value of the larger ecosystem; and (c) establishing incentives for protecting wetlands, including wetland banking.

However, the SMP does not presently contain an overall assessment of the functions of wetlands within the City or a comprehensive wetland management plan to permit alteration of lower quality wetlands and mitigation through enhancement or restoration of higher value wetlands. Furthermore, provisions of Section 37 of the Zoning Ordinance are more detailed regarding wetland categorization and mitigation. This may create confusion in implementing the two City regulations.

The SEWIP document is designed to specifically address the inventory, habitat assessment and management deficiencies of these existing City regulatory programs and act as an "overlay" to both of these documents.

The future revised Shoreline Master Program policies and regulations will balance the need to: (a) protect, enhance, and restore the Snohomish Estuary and associated Puget Sound resources; (b) provide continued port and industrial redevelopment; and (c) provide additional public shoreline access and recreational areas. The revised SMP will offset the impact of new development through a combination of onsite and offsite mitigation and through restoration of degraded aquatic resources, including the remediation of areas of existing toxic contamination and use of "state-of-the-art" water and air pollution regulations and monitoring programs.

401 Certification Process For every project requiring review under Section 404 of the Clean Water Act, a Section 401 "certification" review must also be conducted by the Department of Ecology. The purpose of the Section 401 certification is to ensure that federally permitted activities comply with the federal Clean Water Act, state water quality laws and any other appropriate state laws such as the Hydraulic Code. State 401 certifications are exempt from State Environmental Policy Act requirements. If the Department of Ecology denies certification, the federal permitting agency must deny the permit. If the state imposes conditions on a certification, the conditions become part of the federal permit. Under the SEWIP document, the City will seek a "pre-certification" from the Department of Ecology for development permitted under the plan rather than obtaining individual 401 certification for each development proposed.

State Hydraulics Code The Hydraulics Code requires approval from the Department of Fish and Wildlife (WDFW) before work may be done within the ordinary high-water mark of waters of the state.

The purpose of this legislation is the protection of fish life[1]. Department of Ecology Publication #95-100 summarizes the Hydraulic Project Approval authority as follows:

> *"The State Hydraulic Code is intended to protect fish and fish life from impacts associated with 'construction of any form of hydraulic project or performance of other work that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh water of the state' (RCW. 75.20.100 and 75.20.103). While not specifically aimed at wetlands protection, this law is frequently applied in wetland permitting cases. Hydraulic Project Approval (HPA) from the Department of Fish and Wildlife is required for projects described above affecting state waters, including wetlands. When HPA's are conditioned or denied, it is solely for protection of fish life."*

While Hydraulic Project Approval is needed for work in many wetlands, an HPA is not required for work in isolated wetlands that do not contribute to fish habitat. Washington State Department of Fish and Wildlife policies on wetlands (Pol-3100, Pol-409, Pol-410) require mitigation sequencing in the following order: first, avoidance of impact; second, minimization of impact; third, compensatory (replacement) mitigation for unavoidable impacts. These policies direct there be no net loss of wetland acreage or function and no net loss of productive capacity of the habitat of fishes, crustaceans and other shellfish. In compensating for unavoidable wetland losses, Pol-3025 directs a minimum 2:1 area replacement ratio. Less than 2:1 has been allowed for some wetland systems in mitigation banking scenarios where mitigation is done and demonstrated to be functioning or where 2:1 is not feasible. Greater than 2:1 area replacement has also been required when needed to meet functional equivalency.

Department of Fish and Wildlife mitigation policy (Pol-3001) directs onsite, in-kind mitigation; for offsite mitigation to be acceptable, the project proponent must demonstrate to WDFW's satisfaction that greater biological value can be achieved offsite than onsite.

Section 404 of the Clean Water Act (CWA). Under Section 404, the Corps of Engineers regulates the discharge of dredged or fill material into waters of the United States, including wetlands. The purpose of this Act is to preserve and restore the chemical, physical and biological integrity of our Nation's waters through administration of a federal permit program. The U.S. Environmental Protection Agency jointly administers this program through technical review and comment on proposed permit actions to assure that the Section 404 (b) (1) guidelines are met. The Section 404 (b) (1) guidelines are the substantive environmental regulations which were promulgated by EPA and the Corps to assure compliance with Section 404 of the Clean Water Act.

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[1] "Fish life means all fish species, including but not limited to food fish, shellfish, (which includes crustaceans such as shrimp and crabs), game fish and other non-classified fish species and all stages of development of those species." (WAC 220-110-020)

The lack of effective coordinated wetland management and regulation at the local level forces Federal Agencies to focus on the case-by-case review process instead of a regional planning and permit system which could better accomplish the purpose and objectives of both the CWA and local land use and shoreline regulations. Reliance on this process is reinforced by the limited Federal Agency input permitted under the Section 404 process into the local land use planning process. As a result, many local land use decisions are in conflict with the provisions of the CWA, as they are currently implemented by Federal Agencies. The case-by-case review process severely limits the use of innovative mitigation measures such as wetland banking and transfer of development rights. The case-by-case review process is complicated and lengthy, with some decisions requiring up to five years. This process relies on a systematic analysis of site conditions and project design to determine whether impacts can be avoided and alternatives identified before alteration and mitigation is considered. The offsite mitigation of impacts has been approved infrequently due to the lack of regional wetland management plans which could provide the necessary resource information to support such offsite approval.

The purpose of SEWIP is to provide an alternative means to resolve many of these existing conflicts between Section 404 and local land use policies. SEWIP will act as an overlay to the City's Comprehensive Plan, the Shoreline Master Program and Section 37 of the Zoning Code, providing for the protection of the overall functions and value of the area's wetlands and a long-term net gain in wetland characteristics.

Once SEWIP is reviewed and approved by the State and Federal Agencies, the City will request that the Corps of Engineers issue some form of a ***Regional Clean Water Act Section 404 Permit.*** This would allow the City to administer some aspects of the 404 permit process under specific conditions set forth by the Corps consistent with this plan. This approach should create a predictable planning and alternative permitting process which could result in considerable savings of time and money to all parties seeking City permits, while providing for a superior level of wetland mitigation and protection.

Chapter 1 - Description of Process & Methods

1.1 Introduction

The process for developing a scientifically based wetland management plan for the Snohomish Estuary involved the following steps:

1) **Technical Advisory Committee & User Group**. The technical committee was formed to assist in the development of the Inventory and Assessment methodology for the Snohomish Estuary Wetland Estuary Wetland Integration Plan (SEWIP). The Committee consisted of wetland and resource scientists from the City of Everett, Corps of Engineers (COE), Environmental Protection Agency (EPA), Natural Resources Conservation Service (NRCS), Department of Ecology, Washington Department of Fisheries and Wildlife (WDFW), Snohomish County and local consulting firms. See Table 1.1 for a list of members. The User Group consisted of individuals who work, live and recreate in the Estuary. Its purpose was to assign socially important "values" to the functions selected by the Technical Advisory Committee and to assist in development of the final management plan. See Table 1.2 for a list of committee members.

2) **Mapping and Inventory.** Conduct an inventory of the number and types of wetland resources, including vegetated wetlands and mudflats.

3) **Wetland Assessment.** Conduct an assessment of the ecological functions of those wetlands using the Indicator Value Assessment Model (IVA -- see Chapter 4).

4) **Development Footprint[1].** Identify the development footprint within the Estuary based on the wetland assessment and analysis of infrastructure (roads, rail lines, dredged channels) and land use patterns to be reviewed as a part of the Corps of Engineers alternatives analysis.

5) **Restoration Sites.** Identify the restoration sites in the Estuary based on the wetland and mudflat assessment and analysis of physical (elevation, presence of old sloughs and tidal channels), chemical (salinity), and ecological (marine, brackish or freshwater ecosystems) factors.

6) **Restoration Actions**. Identify the restoration actions for each restoration site based on field surveys by the Technical Advisory Committee.

7) **Restoration Credits**. Assess the wetland and mudflat functions of the selected restoration sites and calculate the total potential increase in performance of functions.

[1] After completing the inventory and assessment, the Snohomish Estuary Technical Advisory Committee selected an area in which to encourage development through an expedited permitting process.

Figure 1.1 Process for Developing SEWIP

- Form Technical and User Advisory Committees.
- Develop Habitat Assessment Model.
- Map, Inventory and Assess 11,518 Acres of Wetlands within Estuary.
- Identify Development Footprint.
- Identify Restoration/Enhancement Sites.
- Calculate Compensation Ratios Based on Increase in Performance of Functions.
- Develop Compensation Policies.

8) **Development Footprint Debits**. Compare the projected total loss in functions in the development footprint and compare to the total increase in performance for restoration and enhancement sites.

9) **Compensation Ratios.** Based on the “debits and credits”, calculate the compensation ratio(s) required to prevent any net loss of function.

10) **Compensation Policies.** Develop general compensation policies for the vegetated wetlands and mudflats.

Figure 1.1 outlines the process for preparing this plan. A description of how each of the above steps was completed is presented in the following sections.

1.2 Technical Advisory Committee

The Snohomish Estuary Technical Advisory Committee (SETAC), a team of scientists familiar with the Snohomish Estuary, was formed in January of 1994. The SETAC was comprised of the "core" group of scientists and engineers listed in Table 1.1. The Technical Committee met six times during the Phase 1 Plan development (April 1995 Draft Plan)[1] . Agendas, meeting minutes and staff reports are presented in Appendix A, available as a separate document.

In the initial meetings, SETAC identified the study area, formulated the mapping methodology, determined the composition of habitat evaluation teams, and identified the functions to be assessed within the Estuary. SETAC then developed the Habitat Assessment Model (completed May 18, 1994) and reviewed the results of the habitat assessment. Based on the review of the assessment data, the SETAC determined that three groups of wetlands could be identified: Group 1 -- Wetland complex is very strongly associated with the performance of Estuary functions; Group 2 -- wetland complex is strongly associated with the performance of Estuary functions; and Group 3 -- wetland complex is weakly associated with performance of Estuary functions but may have a high potential for restoration. The breaks in the habitat assessment data for the three wetland groups were identified for each wetland function by SETAC. SETAC also assisted in the formulation of the Chapter 4 wetland and mudflat management policies (April 1995 draft), including the habitat value overlay map.

Once the April 1995 draft plan was completed, the committee began a process of identifying the restoration objectives for the Snohomish Estuary and determined where these objectives should be implemented within the Estuary. The evaluation of wetland complexes for the appropriate objectives were based on the IVA scores and other physical characteristics such as substrate, elevation and presence of old tidal sloughs or streams. Figure 5.1 (page 5-5) presents the form used for this evaluation. With the areas and types of restoration identified, the committee ranked the sites based on technical and social criteria (Figure 5.3, page 5-10). The final ranked restoration sites are presented in Figures 5.4A and 5.4B, pages 5-13 and 5-14).

[1] (1/24/94, 2/17/94,3/10/94,3/24/94, 4/6/94, 5/18/94) and 17 times for the 1997 Phase 2 Plan (6/14/95, 8/9/95, 9/18 to 22/95,10/16/95,11/29/95,12/21/95, 1/12/96, 2/14/96, 2/28/96, 3/21/96, 4/4/96, 4/22/96, 4/29/96, 5/13/96, 5/29/96, 6/17/96, 8/1/96).

Table 1.1 SEWIP Technical Advisory Committee

Fred Weinmann	*EPA Region 10*	*Wetland Ecologist*
Linda Storm	*EPA Region 10*	*Wetland Ecologist*
Duane Karna	*EPA, Region 10*	*Fisheries Biologist*
Evan Lewis	*Corps of Engrs, Regulatory*	*Fisheries Biologist*
Debbie Knaub	*Corps of Engrs, Regulatory*	*Natural Resources Scientist*
Colleen Stinson	*NRCS*	*Wetland Biologist*
Tom Hruby	*Dept. of Ecology*	*Wetland Ecologist `*
Rick Huey	*Dept. of Ecology*	*Environmental Scientist*
Joanne Polayes	*Dept. of Ecology*	*Environmental Scientist*
Erik Stockdale	*Dept. of Ecology*	*Wetland Ecologist*
Brian Williams	*WA Dept. of Fish/Wildlife*	*Fisheries Biologist*
Bob Zeigler	*WA Dept of Fish/Wildlife*	*Wildlife Biologist*
Ted Muller	*WA. Dept. of Fish/Wildlife*	*Wildlife Biologist*
Tony Oppermann	*WA Dept. of Fish/Wildlife*	*Wildlife Biologist*
Sky Miller	*Snohomish County Surface Water Management*	*Hydraulics Engineer*
Paul Meehan Martin	*Snohomish County Public Works*	*Wildlife Biologist*
Darrell Smith	*Snohomish County Surface Water Management*	*Wildlife Biologist*
Jon Houghton	*Pentec Environmental*	*Marine Biologist*
Dyanne Sheldon	*Sheldon & Associates*	*Wetland Ecologist*
Stephen Stanley	*City of Everett, Planning*	*Wetland Ecologist*
Becky Herbig	*City of Everett, Planning*	*Wildlife Biologist*
Jane Zimmerman	*City of Everett, Public Works*	*Water Quality Engineer*
Dan Thompson	*City of Everett, Public Works*	*Forestry Biologist*

During a series of field trips in September of 1995, SETAC identified the restoration "actions" for each of the top-ranked restoration sites, such as removing maximum area of dike for tidal restoration, filling agricultural ditches to encourage dendritic channel formation, reconnecting old tidal sloughs, and streams to the main channel. Based on the projected gains that would result from implementation of these restoration actions and the losses from the filling of the development footprint (both based on IVA scores), the initial overall replacement ratios were determined (see Table 5.5, page 5-19). The development footprint was established by the User Group in the Fall of 1995 and subsequently modified by SETAC (see below).

The IVA model, model assumptions and assessments for each of the 367 wetland complexes were reviewed and revised during the first part of 1996. SETAC also spent considerable time examining the mudflat model, assumptions for answering the questions, and the IVA answers for each mudflat. From January to May of 1996, SETAC developed and refined the General and Mudflat Compensation Policies which are presented in Chapter 2.

1.3 User Group

The Snohomish Estuary User Group was formed in October of 1994 and consisted of individuals who live, work and recreate in the Estuary. Members serving on the User Group are listed in Table 1.2. Agendas and minutes for the User Group are presented in Appendix A, available as a separate document[2]

The primary function of the User Group was to determine what values should be assigned to Estuary functions selected for evaluation. After completing a detailed questionnaire comparing all functions analyzed in the Estuary, the User Group assigned values to the social significance, wildlife and water quality improvement functions. It was the User Group's desire to apply different mitigation values for wetlands within three land use categories: undisturbed wetlands, rural lands, and industrial lands (i.e. development footprint).

Table 1.2

User Group Advisory Committee

Joanne Bryant	***Everett Citizen***
Myrna Williams	***Lowell Resident***
Karen Williams	***Lowell Resident***
Daryl Williams	***Tulalip Tribes***
Barry Margolese	***Land Owner***
Bob Johnson	***Ebey Island Farmer***
Chris Mann,	***Weyerhaeuser***
Stuart Triolo	***Weyerhaeuser***
Everett Alexander	***Ebey Island Farmer***
Laura Zalesky	***Snohomish Wetland Alliance***
Rob Ryan	***Soil Conservation Service***
Werner Furrer	***North Sound Kayak Association***
Herb Carpenter	***Snohomish County Land Trust***
Sally Van Niel	***Pilchuck Audubon***
Ann Robeson	***League of Woman Voters***
Dave Buse	***Buse Timber***
Barney Bagwell	***Ebey Island Dike Commissioner***
Monty Holmes and Shirley Holmes	***Ebey Island Tree Farm***
Dennis Gregoire	***Port of Everett***
Debbie Terwilleger	***County Parks/Land Owner***
Sky Miller	***Snohomish County Surface Water Mgmt.***
Kathie Joyner	***Public Works, City of Everett***
Stephen Stanley	***Planning, City of Everett***

[2] The User Group met on 8/31/94, 9/14/94, 9/28/94, 10/12/94, 10/26/94, 1/25/95, 3/15/95, and 4/6/95.

1.4 Inventory of Wetlands

The methods for conducting wetland inventories are relatively well established and are based on plant species, soil types and the hydrological regime present. Numerous comprehensive resources are available which list and identify wetland plants and soils and assist in the identification of different hydrological regimes. These resources include national and regional plant lists which identify plants by species and their probability of occurrence in wetlands, soil surveys with maps from the Natural Resources Conservation Service (formerly Soil Conservation Service) which identify soil types and hydric classification, and the 1987 and 1989 Federal Interagency Manual for Identifying and Delineating Jurisdictional Wetlands. The initial task of the SETAC was to determine how the Estuary wetlands would be mapped and inventoried.

1.2.1 Mapping Units. The SETAC first considered whether the wetlands should be mapped according to the delineation methodology of the Federal Interagency Manual on Wetland Delineation. It was determined that it would be too time consuming to field delineate and map wetlands in this manner. However, it was unclear how to proceed because the National Wetland Inventory Maps showed that large diked portions of the Estuary were non-wetland despite contrary observations by County and City biologists.

Though large portions of the Estuary are diked and drained for farming, the majority of the soils are still hydric and saturated during the winter and early spring months (see Figure 1.2 for Hydric Soils). For purposes of wetland delineation, wetland hydrology is considered to be present when hydric soils are saturated to the surface for one week or more during the growing season when biological "zero" is exceeded. Biological zero is defined as 41 degrees Fahrenheit at 19.5 inches depth in the soil profile. The beginning of the growing season is approximately March 1 based on studies of when agricultural crops begin to grow. However, recent data collected by both the Corps of Engineers and Department of Ecology (personal communication, Hruby) indicate that biological zero is exceeded in the Puget Sound Region for most of the year. Because the majority of the diked portions of the Estuary cannot be drained due to high river flows in adjacent sloughs prior to March, hydric soils are more than likely saturated to the surface for the requisite one week period during the growing season.

In light of this information, the Committee determined that for the IVA assessment, the Estuary should be mapped on the basis of common hydrology, unless all areas were clearly upland. Each hydrological unit would be called a "wetland complex," and no attempt would be made to determine actual wetland boundaries within the complex. Under this plan, actual wetland boundaries would be determined only when applying development compensation policies.

1.2.2 Wetland Complex Inventories. Plant inventories for each wetland complex were conducted with the estimated percent of dominant plant species for each Cowardin Class (emergent, scrub-shrub, and forested class) recorded, in addition to buffer condition and wildlife observations. See Appendix B for an example of the inventory sheet used.

1.2.3 GIS Mapping. Wetland complexes were base-mapped on computer generated copies of Corps of Engineers (COE) color-infrared aerial photos (8/18/93, scale 1:2000) according to

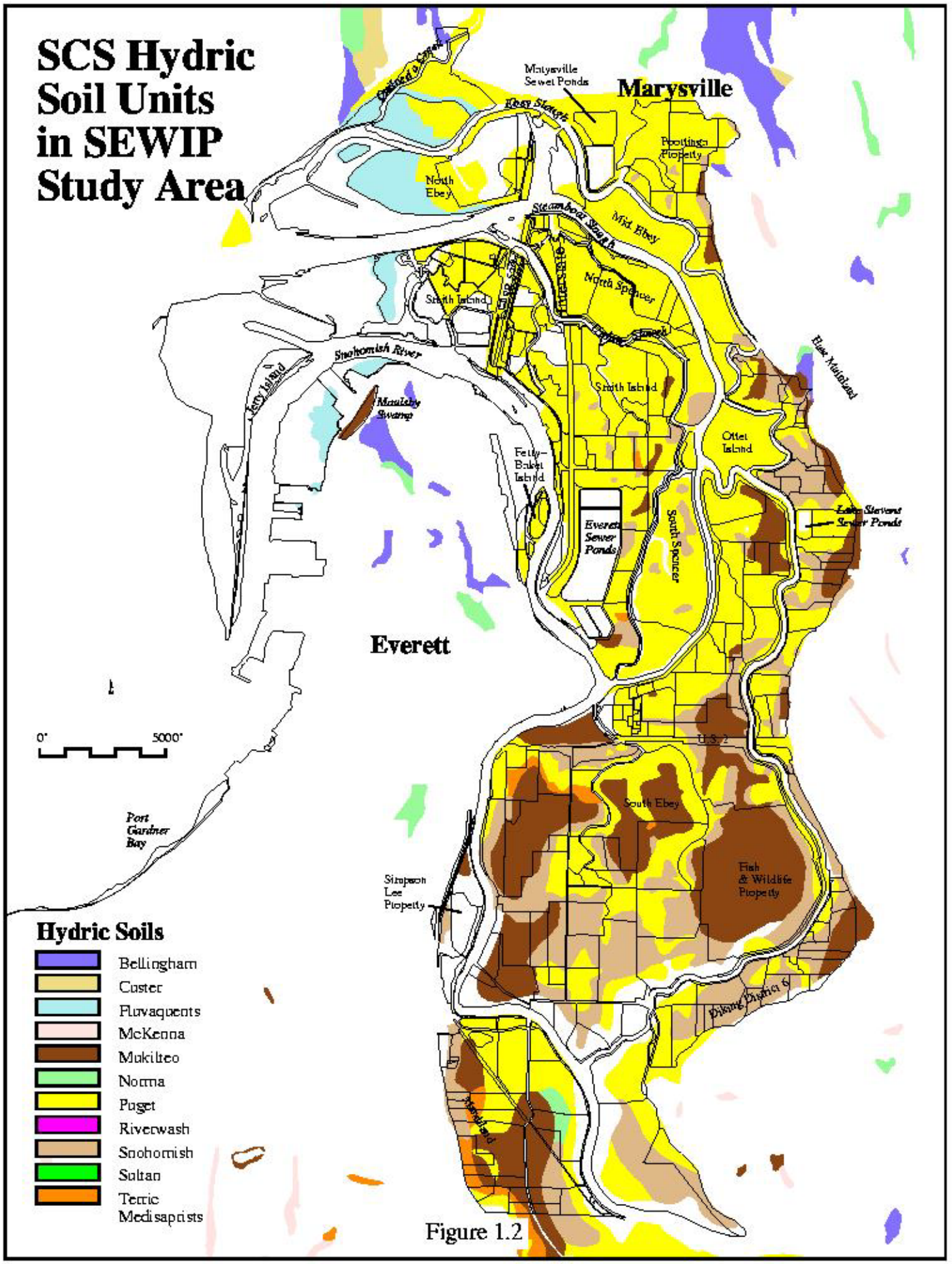

SCS Hydric Soil Units in SEWIP Study Area
Marysville
Everett
Marysville Sewer Ponds
Ebey Slough
Pootinga Property
North Ebey
Steamboat Slough
Mid Ebey
North Spencer
Union Pacific RR
South Island
Snohomish River
Ferry Island
Meadow Swamp
Port Gardner Bay
Smith Island
Ottet Island
Lake Stevens Sewer Ponds
Everett Sewer Ponds
South Spencer
Felty-Baker Island
U.S. 2
South Ebey
Simpson Lee Property
Fish & Wildlife Property
Ebey Slough
0'
5000'
Hydric Soils
Bellingham
Custer
Fluvaquents
McKenna
Mukilteo
Norma
Puget
Riverwash
Snohomish
Sultan
Terric Medisaprists

Figure 1.2

common hydrological boundaries. Black and white aerial photos (2/24/91, scale 1:600) were also used to assist in the mapping of units. The COE color infrared aerials were scanned directly into the City's Geographic Information System and printed out to use for mapping in the field. This allowed for digitization of wetland complex boundaries directly off the field maps.

1.2.4 Habitat Classification System for Field Mapping. Field teams used a modified Cowardin System to describe wetland habitat within the Estuary (see Section 2.3 for a more detailed explanation.) The Estuarine intertidal and palustrine systems were primarily used with the classes being limited to unconsolidated shore, aquatic bed, emergent, scrub-shrub, and forested. Dominant classes were based on a minimum 30% area coverage of the wetland complex being inventoried and assessed. Secondary classes were based on a minimum 10% area coverage.

1.5 Wetland and Mudflat Habitat Assessment Model

The purpose of the SEWIP process is to evaluate a range of wetland/mudflat functions and measure the performance of those functions for all wetlands within the study. This evaluation provides the basis for identifying the highest and lowest performing wetlands/mudflats and the areas suitable for long-term protection, restoration, enhancement and development. Functions are defined as the physical, chemical and biological processes or attributes that contribute to the self-maintenance of wetland ecosystems (see further discussion under "Functions" below.) To assign a "quantifiable" numeric value to wetland functions for a specific wetland requires detailed knowledge of the interaction of the physical, chemical and biological components within that wetland's ecosystem. Typically this requires years of study to identify the habitat requirements and life forms of species within the ecosystem and to identify relationships between the species and their environment.

Ideally, with this type of in-depth knowledge, a wetland ecologist would have to identify only the type of habitat (including basic vegetation structure, hydrology, landscape features and connections, and buffer type) to know how well wetland functions were being performed. This type of detailed knowledge of the "quantitative" performance of wetland functions is more than a decade away (Hruby et al., 1995). Further, the existing wetland function assessment models, such as the Wetland Evaluation Technique (WET), the U.S. Fish and Wildlife Service's Habitat Evaluation Procedures (HEP), and the Reppert method (Reppert et al., 1979), do not specifically measure the performance of functions or allow for the comparison of wetland performance and value between individual wetlands.

Nevertheless, there is sufficient knowledge regarding performance of a wetland function at a general level when certain basic indicators are present. For example, a wetland with a restricted outlet performs the "water quality improvement" function better than a wetland with an unrestricted outlet because water velocity is slow enough to allow retention of pollutants and nutrients through the physical deposition of sediment, the chemical ”binding” of heavy metals and nutrients to the deposited sediments, and the uptake of these pollutants and nutrients by wetland vegetation. A tidal wetland with dendritic channels performs the "fishery" function better than one without such channels because the channels provide: “refuge” habitat for juvenile fish from larger predators; substantial source of food in the form of insects dropping from overhanging channel vegetation into the water; and shaded, cooler water relative to the larger slough channels. The SEWIP study developed a wetland function evaluation method

that measures performance at this more general "qualitative" level and ranks wetlands in a "semi-quantitative" manner.

In developing the wetland function assessment model, it was necessary first to identify those functions that were ecologically important to the Estuary and socially important to humans. The SETAC selected 16 functions in the Estuary (Figure 1.3). Further description of the functions is presented in Section 1.4.

In reviewing several wetland function assessment models, including the Oregon Freshwater Assessment and Wetland Evaluation Technique (WET), it was determined that the Indicator Value Assessment (IVA) protocol would be used. The primary advantage of this model relative to others is that it can be designed specifically for the wetlands being evaluated, and it allows comparison of functional performance of wetlands within a defined regional area.

The IVA model is based on the assumption that a wetland with a greater number of indicators for a particular function is performing that function better than a study area wetland with fewer indicators present. Numeric scores are assigned to all wetlands within a study area on the basis of the number of indicators present for each wetland, and the wetlands are ranked from 1 to 100 according to their score. To determine the number and type of indicators present within an evaluated wetland, the committee devised a series of "indicator questions" specifically for the Snohomish Estuary. These questions were answered in the field, and the answers "indicated" whether the biological, chemical and physical conditions that are important to the functioning of the Snohomish Estuary ecosystem were present (see Appendix B). The model also includes questions pertaining to "social functions" that are important to humans such as recreation (includes shoreline access), navigable waterways for coastal-dependent industry, hunting, fishing, boating and wildlife observation.

Based on their scientific knowledge of coastal wetlands within the Northwest and the Estuary, the SETAC assigned numeric values to each indicator question. The assigned values depended on whether the indicator question was: very strongly associated (numeric value = 3); strongly associated (2); or weakly associated (1) with the function being assessed. A multiplier or fraction was applied when an indicator resulted in significantly higher performance (e.g. the presence of dendritic channels indicating greatly improved fish habitat) or decreased performance (e.g. cultivation of fields). Appendix B provides a detailed description of the IVA model.

The indicator questions are separated into categories of wetland "function" such as Fish, Birds and Other Species, Primary Productivity, and Water Quality Improvement. The model also contains questions which reduce the overall habitat score if “disturbance” features are present on the wetland complex being evaluated, such as cultivation, drainage ditches, or fill activities. This evaluation model allows each wetland complex (as defined by a common hydrological boundary, such as ditches, dikes or sloughs) to be assigned a numeric value, and therefore to be compared to all other "wetland complexes" within the Estuary. This will allow the regulatory agencies to determine where the highest and lowest performance wetlands are located and provide a basis for offsite mitigation planning.

Figure 1.3 - Functions Selected For Estuary

Functions for Vegetated Wetlands (+7 MLLW)

Attribute	Function
Social Significance[3]	Stabilization of shoreline & channel & access to transportation corridors Recreation (boating, fishing, wildlife observation) Priority species habitat (eagles, Ospreys, Arctic terns, Canada geese) Aesthetic value
Water Quality Improvement	Sediment stabilization Sediment toxicant retention Nutrient retention/transformation
Export of Primary Production	Export of primary production
Fish Habitat	Fish habitat (includes rearing, feeding, migration, & shallow water refuge functions) Non-anadromous Anadromous
Bird Habitat	Bird habitat Migratory Overwintering Nesting
Other Species Habitat	Other species habitat Invertebrates Herptiles (reptiles & amphibians) Mammals

[3] Note that the "Social Significance functions" represent values assigned by humans to either a single or combination of ecosystem functions, based on the perceived importance and/or benefit of those functions to humans. The other functions represent biological, physical and chemical processes that comprise the Estuary ecosystem.

Figure 1.3 - Functions Selected For Estuary, continued

Functions for Sand/Mudflat and Subtidal Wetlands (-10 to +7 MLLW)

Attribute	Function
Social Significance	Access to transportation corridors Recreation (boating, fishing, wildlife observation) Priority species habitat (eagles, ospreys, Arctic terns) Aesthetic value
Water Quality Improvement	Sediment stabilization Sediment toxicant retention Nutrient retention/transformation
Fish Habitat	Fish habitat (includes feeding, migration, & shallow water refuge) Non-anadromous Anadromous
Bird Habitat	Bird habitat
Invertebrate Habitat	Invertebrate habitat Epibenthic Infaunal
Other Species Habitat	Other species habitat Mammals

1.5.1 Description of Functions. A general description of the functions selected by SETAC for both vegetated wetlands and mudflats is provided below. The first five functions are “socially significant” functions that have been identified as having additional “value” to our society.

Access to Water - These are areas that are directly adjacent to navigable, dredged bodies of water (the main channel of Snohomish River north from Highway 2 and Port Gardner Bay Waterway) that provide access for water-dependent industry or recreation. Water dependent industry and recreation is defined as "those activities that require a location on or adjacent to the water in order to function." This includes transport of wood products to and from log storage/sawmill operations, marinas, commercial fishing facilities, boat building/repair facilities, shipping facilities for the transport of finished products or raw materials, boat launches, and wildlife observation facilities.

Channel Stabilization - This function includes shoreline stabilization structures designed to minimize erosion along the main slough “navigable” channels and to protect developed areas and farm lands. This includes rock rip-rap, pilings, and bulkheads. This function was not applied to mudflats.

Recreation - The recreation function includes both land and water based recreation: hiking, biking, horseback riding, hunting and fishing, wildlife observation, kayaking, canoeing, motor boating.

Priority Habitat and Species (PHS) - The Priority Habitats Species list and maps are tools of the Habitat Program at the Department Fish and Wildlife to identify the most important fish and wildlife habitats for resource planning. These tools are made available to local governments and planning departments to assist in their long-range and short-term planning efforts. In addition, the Department of Fish and Wildlife establishes specific definitions for Priority Species which include game species (waterfowl) and species of ecological importance such as the Dungeness crab, pileated woodpecker, great blue heron, Columbia black tailed deer and mink. Though state law does not establish specific definitions for Priority Habitat and Species, the Department of Fish and Wildlife has developed the following definitions:

> **Priority Habitat**: A habitat type with unique or significant value to many species. An area classified and mapped as priority habitat must have one or more of the following attributes:
>
> - Comparatively high fish and wildlife density;
> - Comparatively high fish and wildlife species diversity;
> - Important fish and wildlife breeding habitat, seasonal ranges, movement corridors;
> - High vulnerability to habitat alteration;
> - Unique or dependent species.
>
> **Priority Species**: Wildlife species requiring protective measures and/or management guidelines to ensure their perpetuation.

This function addresses those species that are highly valued by society for their symbolic, aesthetic and ecological significance. This typically includes highly visible species such as bald eagles, osprey and Arctic tern. For a complete list of PHS species expected in the study area, please see Table G-2 in Appendix G, available as a separate document. Some of these species are protected by specific regulation. For example, the Washington Department of Fish and Wildlife Hydraulic Code requires protection of habitat for salmonids, surf smelt, and sand lance. The PHS program has no regulations protecting species or their habitat.

Aesthetic - The open space qualities of the Estuary, including its various types of wetlands (mudflat, salt marsh, Sitka spruce swamp, cattail/bulrush marsh, scrub/shrub wetland, wet meadow) and the grazed and cultivated agricultural lands.

Water Quality Improvement Functions - This includes sediment stabilization, nutrient retention, and toxicant retention.

A. Sediment Retention - Wetlands perform an important function by trapping suspended sediment. Up to 90% of sediment can be removed by wetlands. Excess sediment can result in the smothering of aquatic insect larvae and fish spawning areas and a reduction in photosynthesis if it is a chronic problem.

B. Nutrient Retention - Wetlands retain and recycle nutrients, including nitrogen and phosphorous. Algae blooms occur as the result of excess nutrients and result in a significant reduction of oxygen in the water column. This oxygen deficiency results in fewer aquatic species, including fish. This is more of a problem in ponds and slower moving bodies of water than at the ocean/river interface of the Estuary where significant mixing of ocean and riverine waters takes place.

C. Toxicant Retention - Toxics, such as heavy metals, typically adsorb to sediment particles which "settle out" in the wetland soils. The oxygen-deprived soils of wetlands promote chemical reactions which further bind pollutants to wetland soils. Therefore, they play an important role in limiting the degree to which these pollutants can move into the higher food chain, protecting the health of larger organisms, including humans.

Primary Productivity - This is defined as the rate at which radiant energy from the sun is stored through the photosynthesis and chemosynthesis activity of bacteria, single-cell algae (including diatoms - microscropic single-celled algae encased in silica), larger multiple-celled algae (known as macroalgae - seaweeds), and vascular “rooted” and “floating aquatic” plants. Photoassimilation by bacteria, another form of photosynthesis, can occur in oxygen-depleted waters polluted with organic materials (such as sewage) and is also considered a source of primary productivity. Primary productivity of coastal marshes and estuary ecosystems is among the highest of any ecosystems on earth. The biomass exported by estuarine marshes plays a very important role in supporting the vast and complex marine food chain, starting with secondary consumers such as zooplankton. This food chain in turn supports many biologically and commercially important marine species, including all salmon species, flatfish, dolphins, porpoises, seals, whales, shorebirds, migrating waterfowl, predatory birds and terrestrial mammals.

Fish Habitat - The wetlands and mudflats within the Estuary provide fish and shellfish species a wide variety of refuge, nursery and feeding habitats. The shallow meandering channels of salt marsh, cattail-bulrush wetlands, Sitka Spruce Swamps and tidal inundated mudflats are particularly important. Drainage channels within diked areas that are connected to the river through tide gates support abundant populations of threespine sticklebacks but provide limited habitat for salmonid species. Vegetation overhanging channel habitat reduces solar warming of the water and consequently helps maintain the oxygen content of the water at a level that will support fish and shellfish species. Terrestrial and aquatic insects, in addition to copepods, amphipods, decapods, and mysids that are abundant in estuarine wetland channel habitat, are a major food source for juvenile salmonids. Wetland channels and shallow edged habitat provide juvenile fish a critical refuge from predators. Channels that have been straightened, dredged, and rip-rapped lose many of these important habitat functions. The sand flat, mudflat, macro algae and eelgrass habitats in the outer portions of the Estuary also provide critical refuge and rearing habitat for a wide variety of fish and shell fish species including salmonid species, herring , smelt, flat fish species, hardshell calms and Dungeness crab. In addition, these same outer Estuary habitats provide habitat for hardshell calm and Dungeness crab reproduction.

Bird Habitat - Bird habitat includes areas used by migrating waterfowl (brant, geese, tundra and trumpeter swans, green-winged teal, canvasback, etc.), overwintering birds (dunlin, rough-legged hawk, peregrine falcon), breeding birds (Canada geese, bald eagle, osprey, etc.), and resident birds (great blue herons, kingfisher, red-tailed hawk, great horned owls, etc.). The diverse habitat types within the Estuary, including agricultural lands, provide a wide range of foraging, nesting and roosting habitats. For example, great blue herons can be found foraging in the ponds, fields and ditches of agricultural lands as well as the cattail marshes and outer Estuary mudflats. Other species such as the osprey nest and forage primarily within the outer mudflat saltmarsh area of the Estuary.

Invertebrate Habitat - The Estuary supports a wide variety of invertebrate species ranging from freshwater, wetland, and upland species of insects and soil invertebrates in Ecological Management Units 1 and 2 to increasingly marine species in Unit 3.

The level of productivity of estuarine and marine invertebrates is significantly higher than that of fresh water, riverine invertebrates. Invertebrate production for estuarine/marine invertebrates from 0 to 200 meters is estimated at approximately 200 grams per square meter versus only 128 grams per meter for rivers (Barnes and Mann, 1980). The productivity of these estuarine and marine invertebrates is due primarily to the unlimited food supply provided by the plant "detritus" exported from adjoining salt and brackish water marshes. These invertebrates serve as an important food source for fish, birds and other mammals in addition to making nutrients available to the estuarine wetlands on incoming tides. This "detrital food web" is one of the most significant and complex ecological systems within coastal estuaries and underscores the importance of mudflat habitat. The marine/estuarine invertebrates include an abundant population of zooplankton within the water column, on rooted submerged vascular plants such as eelgrass, and at the sediment/water interface. Primarily small crustaceans, these species provide the primary prey base for numerous fish species including juvenile salmonids, sand lance and smelt. Invertebrates residing within the sediments include clams, polychaete worms and other crustaceans (amphipods, isopods, cumaceans) which comprise the food base for

other fish (e.g. flatfish), birds (shorebirds and diving ducks), and larger invertebrates (Dungeness crab).

Terrestrial invertebrates are found within the Estuary and typically include insects such as flies, mosquitoes, and dragonflies. Chironomid insects (a type of fly) play a large role in the diet of juvenile chum and fall chinook salmon.

A wide variety of insects also spend a portion of their life cycle in aquatic environments and serve as an important food source for fish, freshwater crawfish and birds.

Herptile Habitat - This group includes amphibians and reptiles. The preferred habitat typically includes freshwater ponds, ditches and emergent wetlands (rushes, sedges) that are not tidally influenced. Typical species found in the Estuary include Pacific tree frog, northern red-legged frog, bullfrog, and common garter snake. These species play an important role in controlling insect and rodent populations and, in turn, serve as a valuable food source for raptors and other piscivorous (fish-eating) birds, such as the great blue heron.

Mammal Habitat - The Estuary's wetlands support a very diverse population of mammals, including: salt marsh (outer Estuary) - river otter, raccoon, coyote; river mouth areas - harbor seal and California sea lion; brackish marsh (Otter Island) - deer, coyote, beaver, muskrat, river otter, mink and raccoons; freshwater marsh (fisheries and wildlife property on Ebey Island) - coyote, porcupine, river otter, deer, cougar, beaver, muskrat, mink, raccoons and smaller mammals. Most of these mammals readily migrate throughout most of the Estuary, with the larger mammals swimming the sloughs to access mainland upland habitat. Agricultural fields do not serve as barriers, and these mammals typically move from one forested and/or scrub/shrub area to the other.

1.5.2 Field Work. Two teams of biologists and resource specialists (wetland ecologist, fishery biologist, wildlife biologist, environmental scientists) spent five months from May 1994 to September 1994 mapping and assessing 367 wetland complexes within the study area. A list of assumptions for applying the model was reviewed and revised by a SETAC sub-committee. (See Appendix J for List of Assumptions.) A rigorous review of all data for consistency with the List of Assumptions was then conducted by the team members over a two month period.

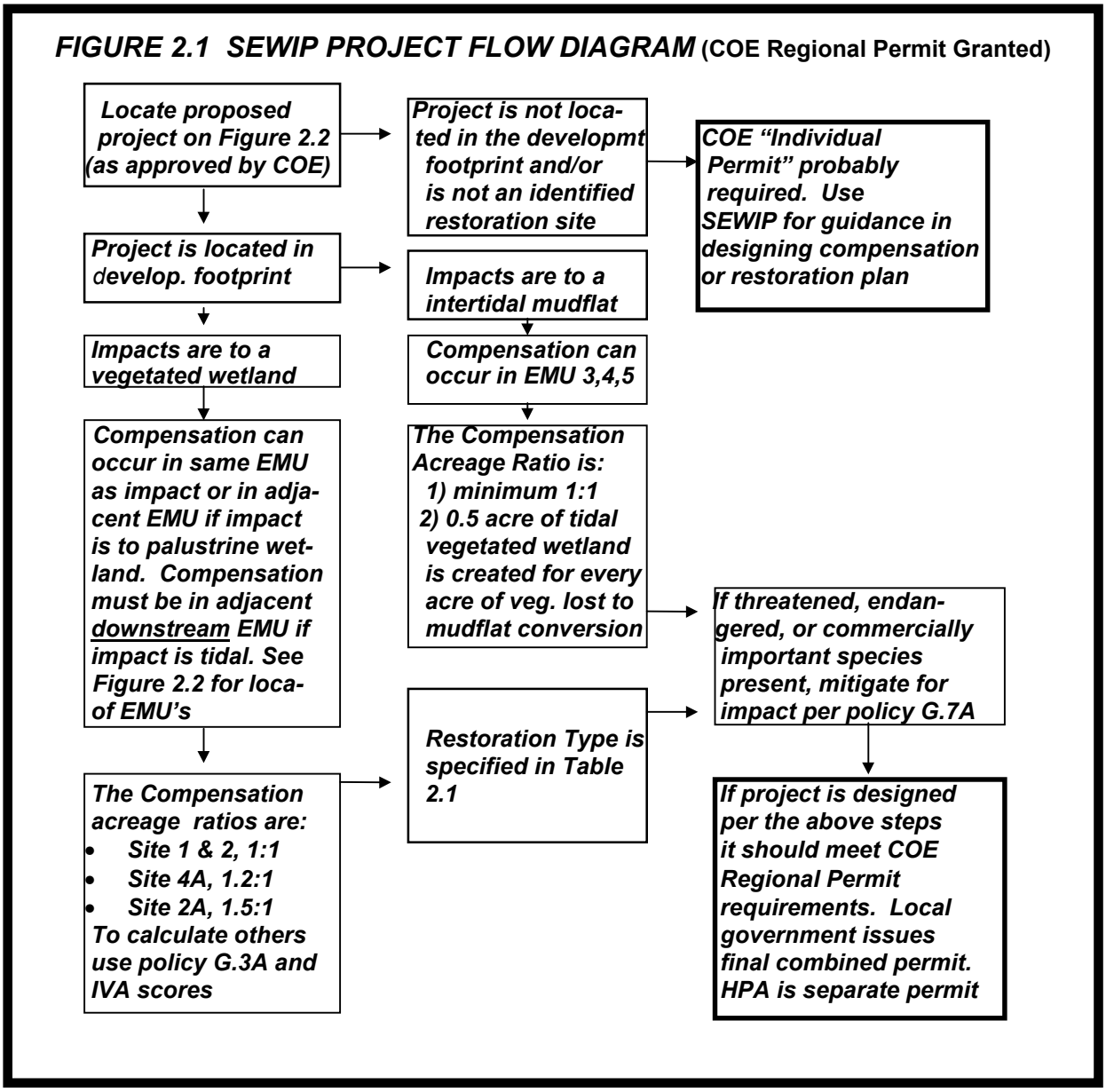
Chapter 2 - Compensation Process & Policies

For projects located in the Snohomish Estuary, this chapter is designed to provide immediate assistance to the policy maker, planner, private citizen, land owner, or developer in assessing:

- The type, amount and location of compensation required for a project;
- The best locations for mitigation banking projects;
- The best locations for restoration projects;
- The probable location for development in the Estuary (development footprint); and
- The type of permitting that will be required.

To obtain this information, use the following flow diagram:

FIGURE 2.1 SEWIP PROJECT FLOW DIAGRAM **(COE Regional Permit Granted)**



The compensation policies listed below are to be used in conjunction with the management plan set forth in Chapter 5. Though the development footprint, restoration sites and restoration actions for each restoration site are presented in Figures 2.3A and 2.3B and Table 2.1, Chapter 5 provides more detail on how these components of the management plan were developed.

Because the compensation policies apply only to projects that meet the requirements of the SEWIP wetland management plan and the Corps regional permit (when issued), they may not be applicable to projects requiring an "individual permit" from the Corps of Engineers. An "individual permit" will probably be required for projects that are either not within the development footprint or restoration areas as approved by the COE and/or do not meet the specific restoration requirements of this SEWIP document. Applicants filing for an "individual permit" will usually be required to follow current state and federal wetland compensation policies, unless the permitting agencies decide that the SEWIP policies will provide adequate compensation for the impacts proposed. Further, though these policies may be used as guidance for developing compensation for sites within the Estuary outside of the development footprint, environmental conditions may be present which may require levels of compensation different from that required by the policies below.

The management plan emphasizes restoration to historic tidal functions and also includes protection of existing palustrine functions. (See Table 2.1 for listing of restoration actions.) Though Chapter 5 identifies enhancement actions for palustrine wetlands, they are identified as "voluntary" only and not to be used as part of the regulatory compensation process set forth in the policies below.

Compensating for unavoidable wetland impacts by restoring historic wetlands in the Snohomish River Estuary may result in a net loss of wetland acreage. To minimize the impacts of this approach on the wetland landscape of the region, the following policies are adopted as part of the plan.

- **G.1 Unavoidable Impacts.** Unavoidable impacts to wetland functions in the Snohomish River Estuary shall be compensated by restoring historic wetlands in the Estuary identified in the restoration plans (Table 2.1 and Chapter 5). Impacts occurring within the Estuary outside of the development footprint approved by the COE shall not qualify for the regulatory provisions set forth under the SEWIP regional permit issued by the COE.

- **G.1A. Out-of-Kind Compensation.** Development impacts to tidal or tidally influenced wetlands shall not be compensated for with palustrine wetland enhancement, restoration or creation.

- **G.1B. Where Compensation Can Occur.** Compensation for impacts to vegetated palustrine wetlands may occur within the same Ecological Management Unit or within the adjacent Ecological Management Unit (See EMU Map, Figure 2.2). Compensation for impacts to vegetated tidal wetlands may occur within the same Ecological Management Unit or within the adjacent downstream Ecological Management Unit.

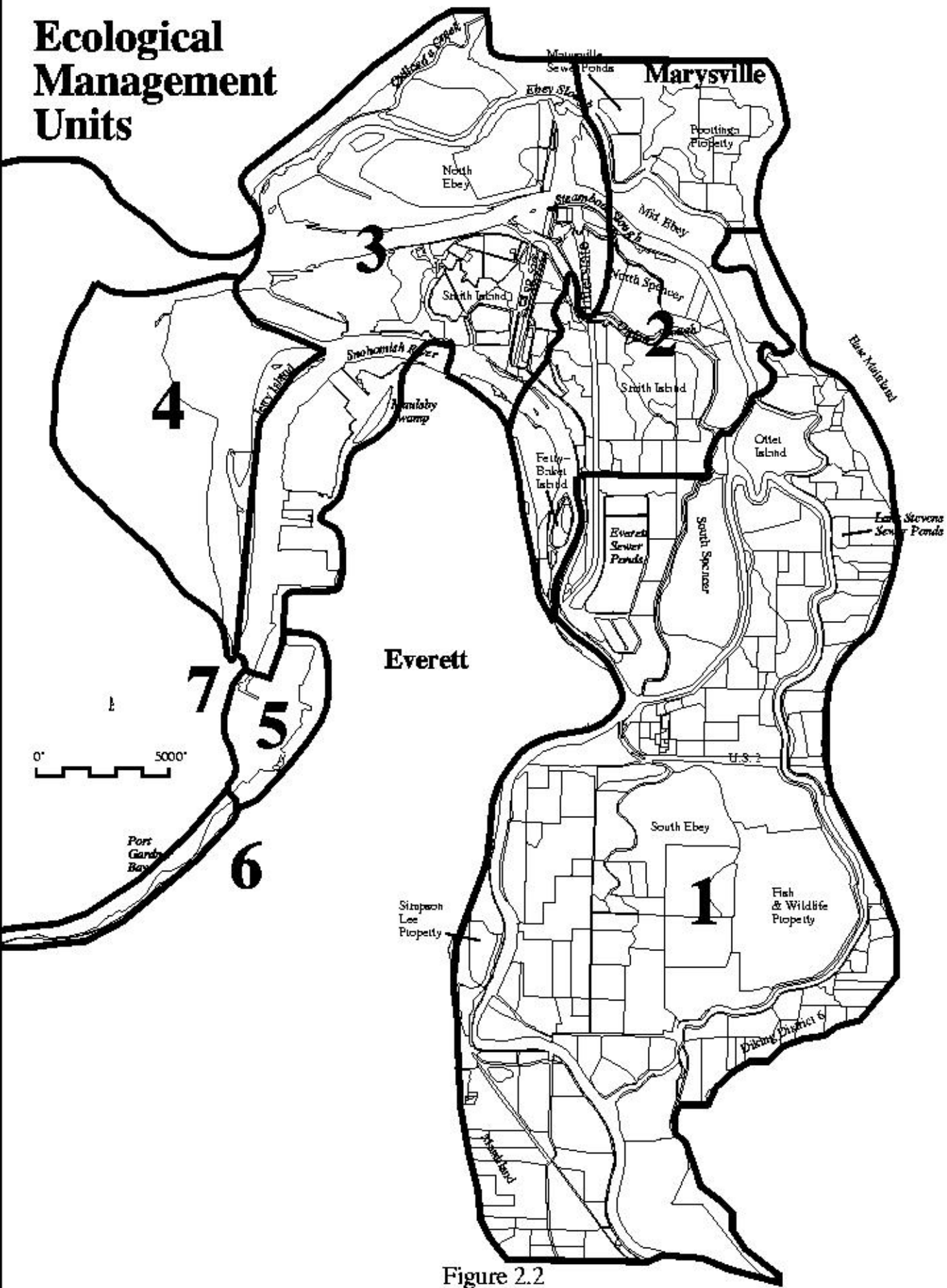

Ecological Management Units
Marysville
Everett
North Ebey
Mid. Ebey
South Ebey
Smith Island
Ebey Slough
Steamboat Slough
North Spencer
South Spencer
Snohomish River
Union Slough
Ebey Island
Hanlaby Swamp
Ferry-Baker Island
Otter Island
Everett Sewer Ponds
Marysville Sewage Ponds
Pootinga Property
Simpson Lee Property
Fish & Wildlife Property
Port Gardner Bay
Tidelands
Dike District 6
U.S. 2
1
2
3
4
5
6
7
0'
5000'

Figure 2.2

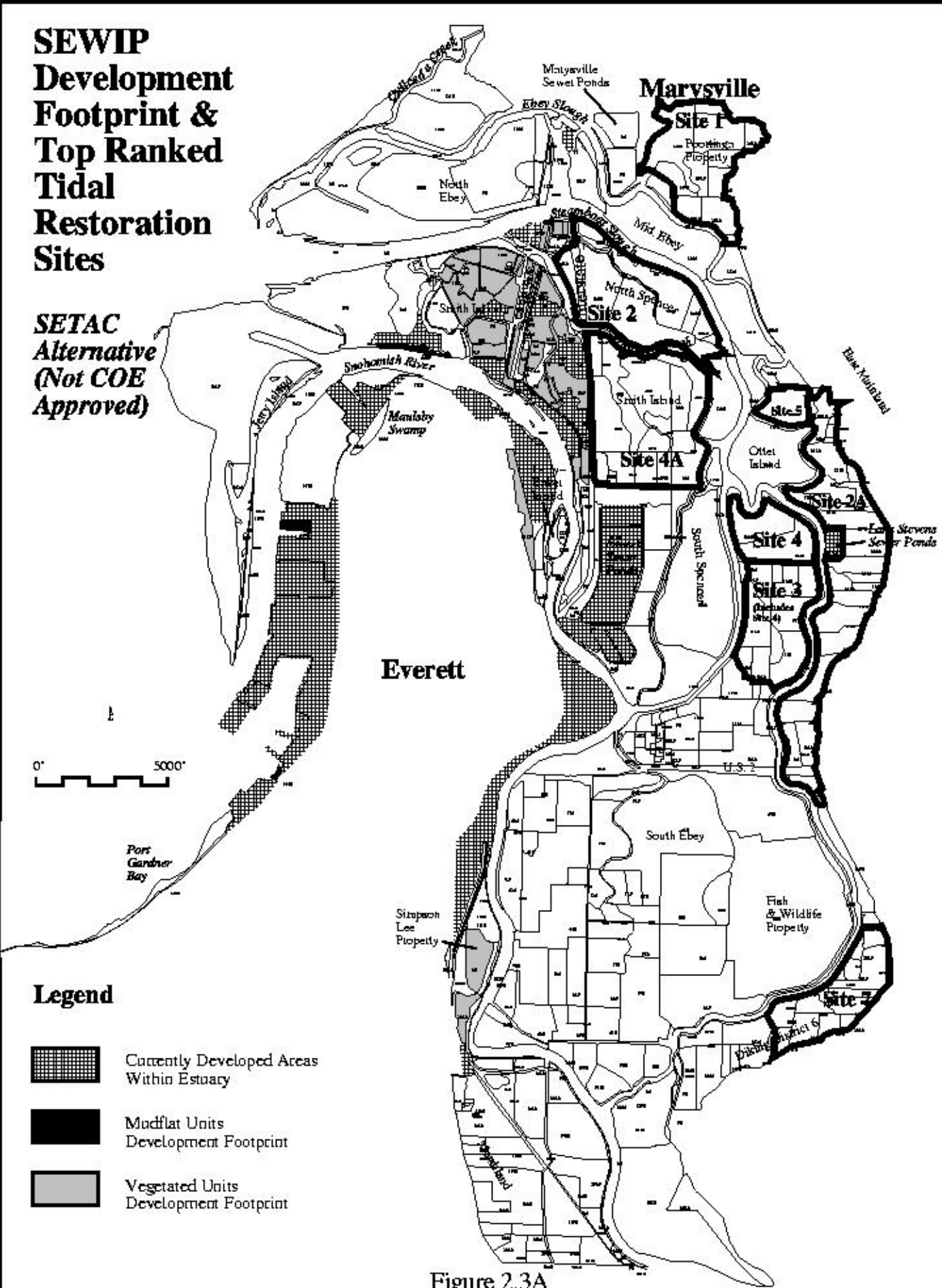

SEWIP Development Footprint & Top Ranked Tidal Restoration Sites
SETAC Alternative (Not COE Approved)
Marysville
Site 1
Site 2
Site 2A
Site 3
Site 4
Site 4A
Site 5
Site 7
Everett
Ebey Slough
North Ebey
Mid Ebey
North Spencer
South Spencer
Smith Island
Ottet Island
Snohomish River
Manilaby Swamp
Port Gardner Bay
South Ebey
Fish & Wildlife Property
Simpson Lee Property
0'
5000'
Legend
Currently Developed Areas Within Estuary
Mudflat Units Development Footprint
Vegetated Units Development Footprint

Figure 2.3A

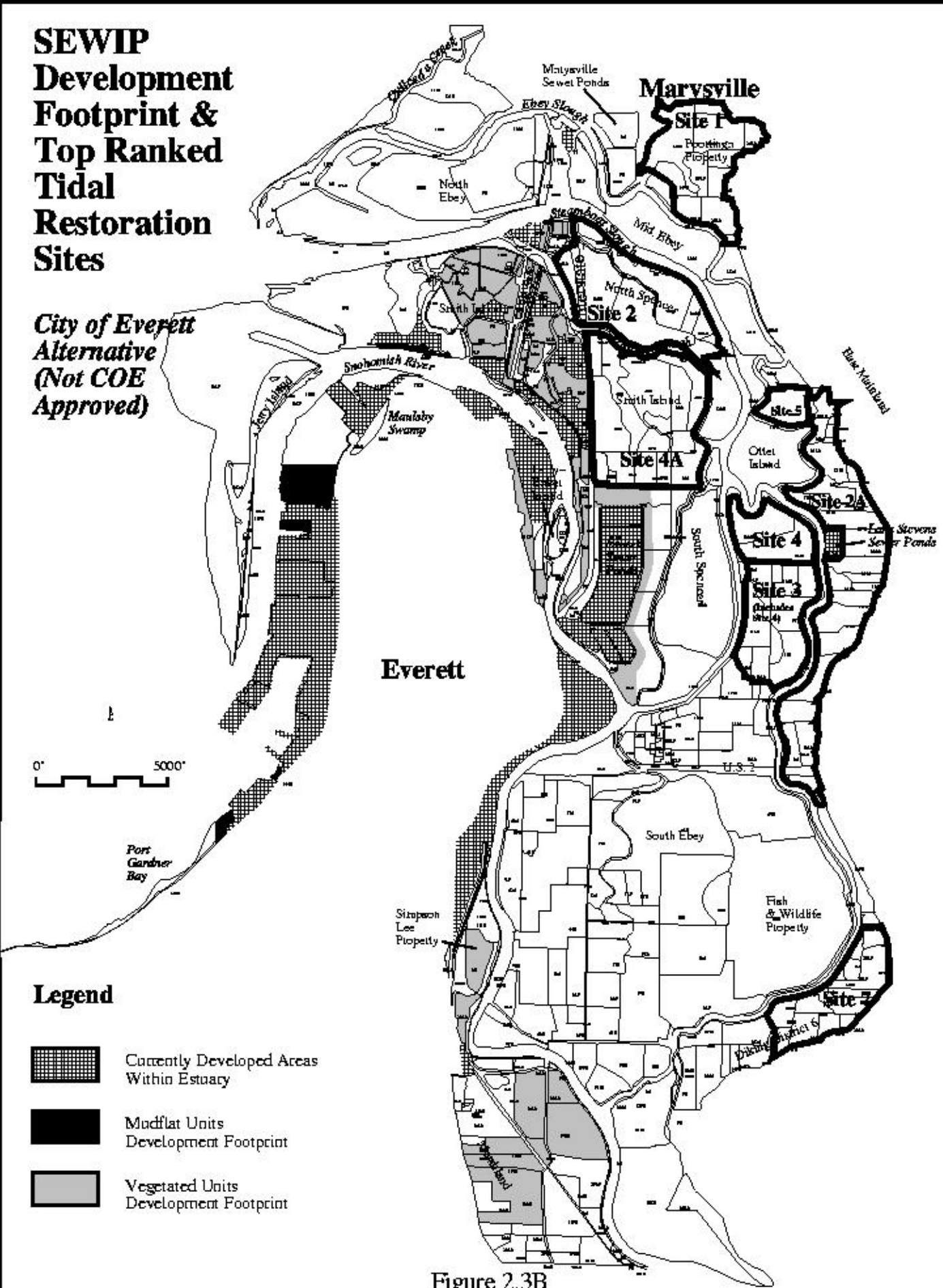

SEWIP Development Footprint & Top Ranked Tidal Restoration Sites
City of Everett Alternative (Not COE Approved)
Marysville
Site 1
Site 2
Site 2A
Site 3
Site 4
Site 4A
Site 5
Site 6
Site 7
Everett
Ebey Slough
North Ebey
Mid Ebey
North Spencer
South Spencer
Smith Island
Ottet Island
Snohomish River
Manilaby Swamp
Port Gardner Bay
South Ebey
Fish & Wildlife Property
Simpson Lee Property
0'
5000'
Legend
Currently Developed Areas Within Estuary
Mudflat Units Development Footprint
Vegetated Units Development Footprint

Figure 2.3B

G.2. Minimum Compensation Requirements. The minimum requirements for compensation will be one acre of restored tidal wetland for one acre of wetland lost.

- **G.3A. How Compensation is Calculated**. The acreage of compensation shall be calculated from the IVA function performance scores using the following ratio, provided that the minimum compensation requirement of policy G.2 is met (see Figure 2.4 for example):

IVA score for per acre function lost / ***IVA score for per acre function gained***	***X (1.25) X (acres lost) =***	***Acreage of Compensation***

This policy applies when the restoration credits are less than the impact debits and the calculated "Acreage of Compensation" will not be less than the acreage loss; otherwise policy G.2 should be applied. The 1.25 multiplier is included in this ratio calculation to compensate for the temporal loss of wetland functions at the impact site during the time required for the functions at the compensation site to approach the "pre-impact" level of performance.

- **G.3B. How Compensation is Calculated When Policies G.2 and G.9 are Met.** In cases where the performance standards established for "year 5" have been met (see G.9), the acreage of compensation shall be calculated from the IVA function performance scores using the following ratio, provided that the minimum compensation requirement of policy G.2 is met:

IVA score for per acre function lost / ***IVA score for per acre function gained***	***X (acres lost) =***	***Acreage of Compensation***

This policy is intended to provide incentive to developers for the creation of large wetland compensation banks. The 1.25 "temporal" multiplier is not included in this ratio calculation because the compensation site has demonstrated through monitoring (Policy G9) that wetland functions are performing as proposed in the compensatory mitigation plan.

- **G.4. Compensation is Based on Limiting Function**. Under Policies G.3A and G.3B, the acreage needed for compensation shall be calculated separately for the Water Quality Improvement and Habitat groups of functions. Whichever group of functions requires the greater acreage for compensation (i.e. which is the limiting group of functions[1]) shall determine the required "overall compensation acreage[2]" in order to ensure that the limiting function is adequately compensated for. Excess compensation acreage[3] for the non-limiting function shall not be available as compensation for other wetland impacts.

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[1] The "limiting group of functions" shall be defined as that group of functions (e.g. Water Quality Improvement or Habitat) which exhibits the least average increase in IVA score per acre for a particular restoration site.

[2] "Overall Compensation Acreage" shall be defined as the required acreage of compensation calculated from policies G.3 for the limiting group of functions (e.g. either Water Quality Improvement or Habitat).

[3] "Excess Compensation Acreage" is when the calculated acreage of compensation for the "non-limiting" group of functions is subtracted from the "Overall Compensation Acreage."

Figure 2.4 Example of Compensation Acreage Calculation

- The Indicator Value Assessment (IVA) model was used to score wetlands in the Estuary for their performance of existing functions (potential functions to be lost) and performance of functions that may be gained through restoration actions.

- $\frac{\text{IVA Score Per Acre Function Lost}}{\text{IVA Score Per Acre Function Gained}}$ x (1.25) x (Acres Lost) = Acreage of Compensation

- The compensation ratio calculation used the scores for the function which resulted in the higher "compensation acreage." This was known as the **limiting function**. Of the two functions, Water Quality Improvement and Wildlife, Water Quality Improvement was found to be the limiting function in the Estuary.

- **Example:** On East Smith Island (Restoration Site 4A), the average IVA for performance of the water quality functions was 31 and the average gain in performance based on tidal restoration was 33. So for 1 acre of wetland lost in the development footprint, the replacement ration would be:

$$31/33 \times (1.25) \times (1) = 1.2 \text{ Acres}$$

Site Location	Table 2.1 SEWIP Restoration Plans for Each Restoration Site														
	Dike Areas			**Tidal Streams and Sloughs**			**Buffer & Habitat Structure**						**Hydrological Regime**		
	Removal of maximum area of dike	*Grade dike down to provide natural shelf transitions from river-slough to wetland*	*Create islands out of remaining dike areas*	*Reconnect remnant tidal streams and sloughs*	*Excavate channels to "pre dike depths"*	*Facilitate natural dendritic channel formation - fill interior drainage ditches, leave larger peripheral ones*	*Restore and enhance minimum 25 foot inland edge of buffer for tidal wetland*	*Restore and enhance minimum 25 foot "edge of field" and exist. streams with scrub-shrub buffer habitat for agricultural wetlands in order to connect larger habitat "patches"*	*Restore scrub-shrub and forested habitat*	*Maintain existing significant areas of scrub-shrub and forested habitat (non-tidal)*	*Restore tidal emergent habitat*	*Maintain and/or enhance existing non-tidal palustrine emergent habitat including existing areas of open water*	*Restore to full tidal regime*	*Restore to partial tidal in order to protect existing signif. non- tidal palustrine habitat. Site culverts at higher elevations rather than use dike break. Culverts should be designed to allow some fish passage.*	*Manage as Non- Tidal Palustrine Wetland with seasonal flooding increased to a minimum of 25% of wetland*
1) Poortinga, WC 146,147,339-343, 360-363	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	-	Yes	-	-
2) N. Spencer (Biringer Farm) WC 268, 295-301, 303-306.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	-	Yes	-	-
2A) Agricultural Lands South of Nyman. WC 124, 130, 178, 210-213, 215, 217-220, 221-226, 229, 326, 327, 337, 338, 333-335, 358.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	-	Yes	-	Yes
3) South Ebey north of Hwy 2, Alter 2, WC 102, 103, 104, 106-108, 110-115, 348	Yes [1] -.	Yes	Yes[2] -.	Yes-	Yes	Yes	Yes	-	-	See Footnote # 3.	Yes	-	Yes	-	-
4) South Ebey north of Hwy 2, Alter 1. WC 103, 104	Yes[1] -.	Yes	Yes[2] -.	Yes-	Yes	Yes	Yes	-	-	- See Footnote # 3:	Yes	-	Yes	-	-
4A) East Smith Island. WC 31, 32, 32.1, 34-40, 42, 42.1 43, 98, 99, 345,	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes		Yes	-	-
5) Nyman Farm . WC 139		-	-	Yes - Limited connection thru culverts	-	Yes	Yes	-	-	Yes	Yes	Yes - Some exist emerg. in Forested area	-	Yes	-
7) Drainage District 6 North of City of Everett water line. WC 230-233, 235-241, 245, 331, 332	Yes	Yes [4]	Yes	Yes	Yes	Yes	Yes	-	-	See Footnote #5	Yes	-	Yes		-

1 - Note: group did not agree on how far south tidal inundation should occur, so two alternatives were selected which will be run through Tech & Economic Criteria
2 - Additional islands would be created in the interior from ditch sidecasting etc. to create new Sitka Spruce habitat that would be lost from tidal flooding
3 - It was decided that this would be very difficult to design and maintain existing forested habitat. Thus snags will be created and new scrub/shrub & forested habitat created on islands and sidecasting from ditches
4 - Limited to areas where dike is removed because dike will be used for pedestrian access
5 - Existing scrub-shrub habitat will be inundated & will die off (snags will be created) on WC 232, 245, & 332.

- **G.5. When to Use Average Restoration Potential Per Acre**. An average restoration potential per acre shall be used to establish the compensation requirements in cases where several wetland complexes are restored simultaneously (as in a compensation bank). This average is to be calculated by summing the potential increase in IVA acre-points for each group of functions and dividing by the total acreage of the site. This average shall then be used to determine the acres of compensation required according to policies G.2 or G.3.

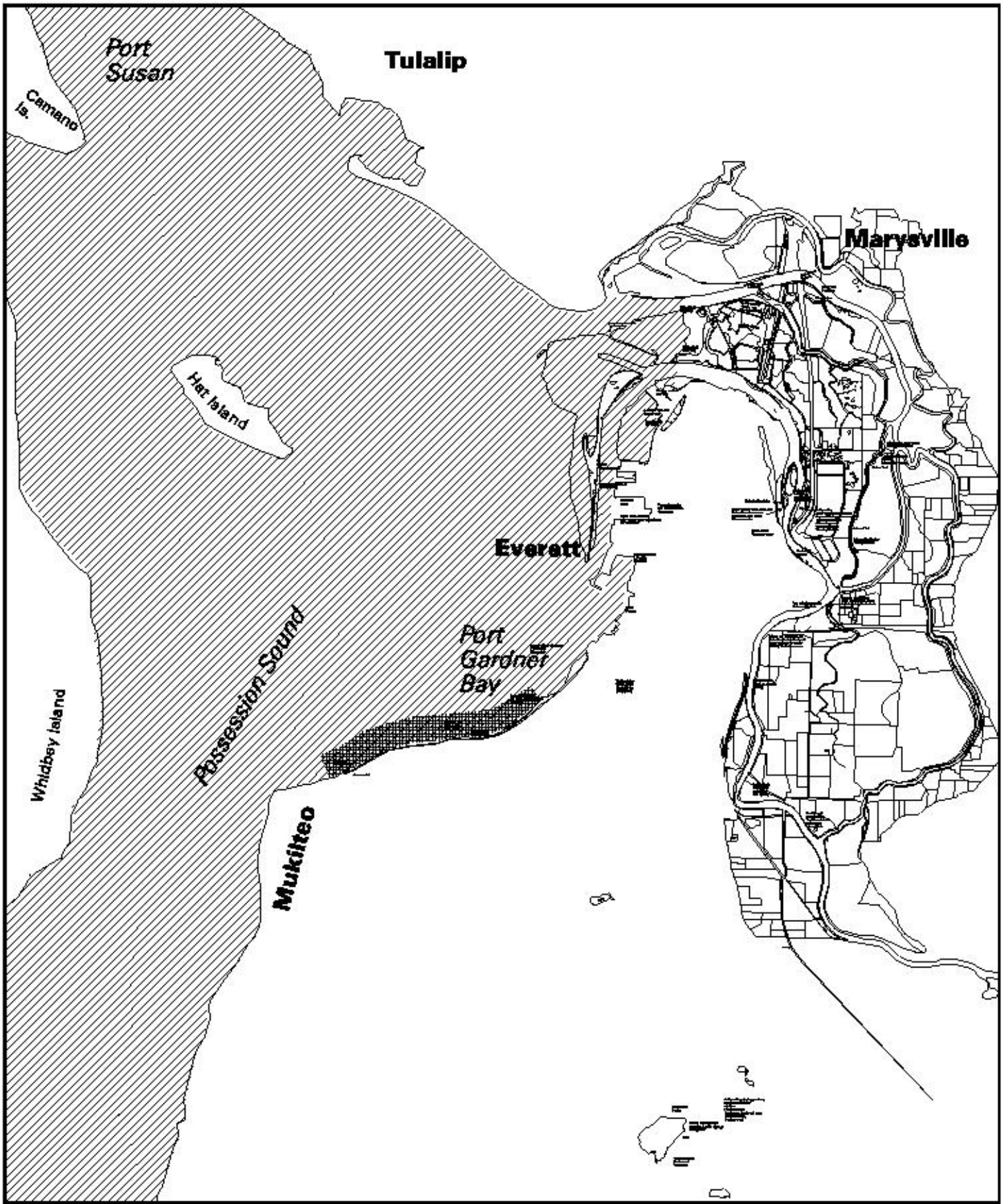
- **G.6. SEWIP Restoration Plan is a Guide for Objectives and Goals.** The SEWIP restoration plan for an individual site must be used as the basis for setting the goals and objectives of any compensation proposed. Any deviation from the goals and objectives for a site identified in the SEWIP restoration plan must be approved by the Technical Oversight Committee or an "individual permit" will be required.

- **G.7. Guidelines for Developing Compensatory Mitigation Plans**. Compensatory mitigation plans with applicable performance standards submitted under the SEWIP plan should follow the interagency "Guidelines for Developing Freshwater Wetlands Mitigation Plans and Proposals" (Department of Ecology Publication #94-29, 40 pp). Applicant will use the overall restoration objectives set forth in Table 5.3. Standards shall be "quantified" (e.g. objective is tidal emergent marsh, standard is 3 acres of tidal emergent marsh at elevation +7 MLLW to +10 MLLW) and be based, in part, on the IVA indicators, specific needs at the site, and standards set in the COE regional SEWIP permit and for other projects such as the Port of Everett Union Slough Restoration Project (South Terminal Development, 1996). The Snohomish Estuary Technical Oversight Committee (SETOC) will provide additional guidance for tidal wetland standards including expected range of tidal inundation, salinity and recruitment of woody debris.

  Although the guidelines were developed for freshwater wetlands, they also provide good guidance for developing plans for restoration of estuarine wetlands. The technical committee also emphasized that compensation designs should include: exact elevation surveys for the proposed tidal restoration sites and adjacent functioning tidal wetlands; an environmental site assessment and any necessary cleanup, and a soil salinity and soil texture survey; hydrological modeling of the restoration site to ensure full tidal exchange; and incorporation of low velocity, off-channel deepwater habitat with adjacent mudflat, emergent marsh habitats into restoration design.

- **G.7A. Threatened, Endangered or Commercially Important Species.** If areas in the development footprint have SEWIP-mapped "threatened, endangered or commercially important species," then the compensation plan shall incorporate design measures to mitigate any impacts to these species. (See Figures 2.5 and 2.6.) SETOC will amend the Plan to incorporate any new mapped areas of threatened, endangered or commercially important species. If a COE regional permit is adopted, then the amendment process must meet the requirements of that permit[1].

[1] Because all involved local jurisdictions and state and federal agencies will have to "agree to" and sign the COE regional permit, a mutually agreeable plan amendment process will have to be worked out at this point. Prior to this time the Plan will be for informational purposes only.

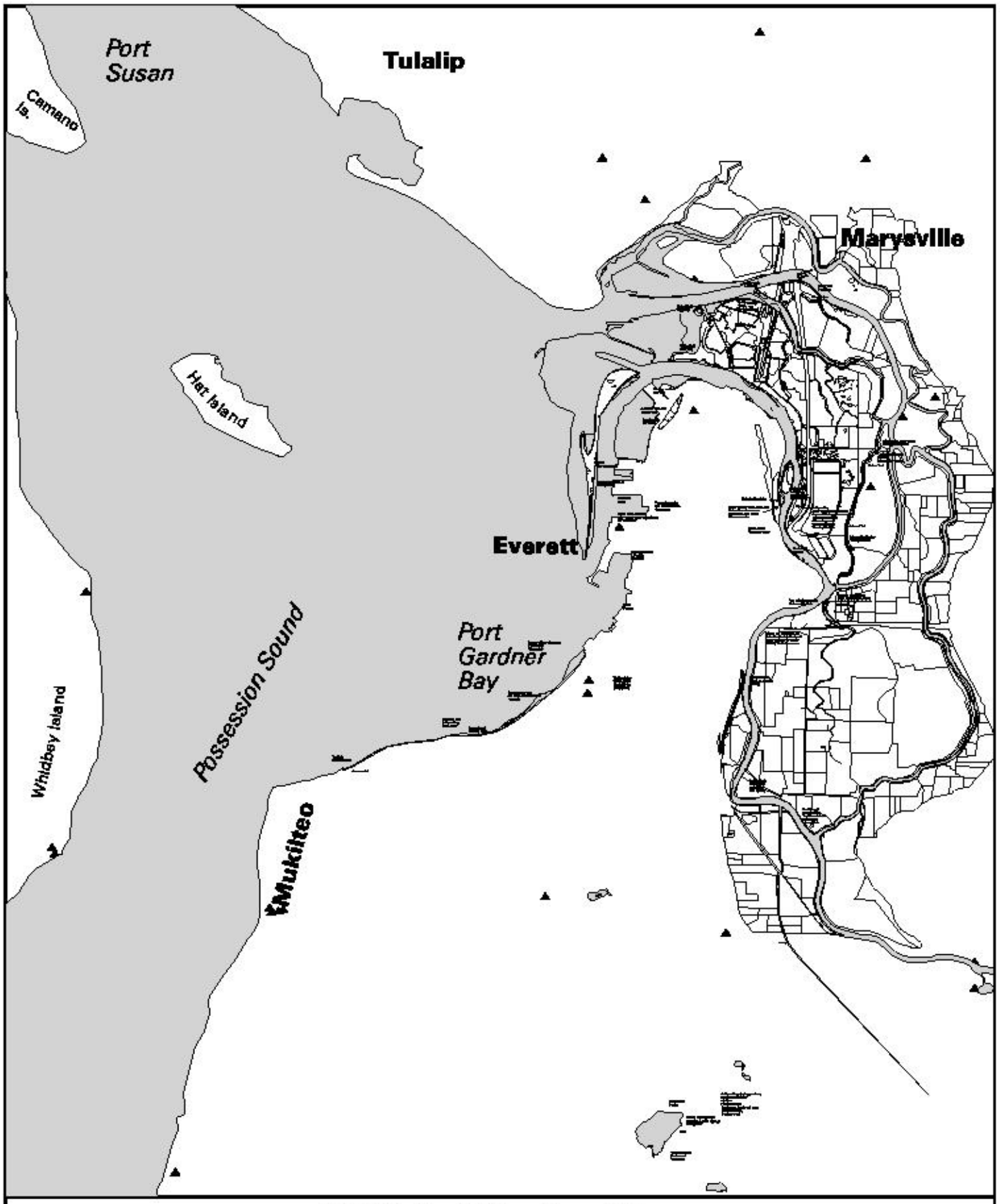


Shellfish Habitat

Dungeness Crab Hardshell Clam

N
No Scale

Fig. 2.5



PHS Bird Nesting Sites

▲ = Nesting Site

Species include Bald Eagle, Great Blue Heron, Osprey, Arctic Tern and Purple Martin.
Species identification are unspecified to protect sensitive wildlife information.

Fig. 2.6

No Scale

- **G.8. Use of Restoration Acreage in Lieu of Maintenance & Contingency Bond**. The restoration of additional wetland acreage may be used in lieu of a maintenance and contingency bond[2]. The area of this "in-kind" maintenance and contingency bond will be equal to the area required for compensation (one additional acre of restoration for every acre needed as compensation). Wetlands that are restored/enhanced for the maintenance and contingency bond may be used or sold by the applicant to compensate for other impacts when all the five-year performance standards established in the mitigation plan are met. Separate bonds for monitoring shall be required. This policy does not apply to mudflats.

- **G.9. Monitoring Requirements**. Each compensation site shall be monitored over a period of 10 years. The wetland compensation plan shall establish a set of applicable performance standards. Additionally, the compensation plan shall include post-project assessment of the site using the IVA model to determine if the projected increase in the IVA scores (restoration potential) for the compensation site has been achieved. When the performance standards established for year 5 are met (which may occur during any year of the monitoring period) and the increase in IVA points projected for the compensation site has occurred, then policy G.3B may be applied.

- **G.10. Projects With Impacts Outside of the Estuary Study Area.** Projects with impacts outside of the SEWIP study area may be compensated for within the SEWIP study area, consistent with the SEWIP restoration and/or enhancement goals and objectives. The SEWIP regional permit will not apply to these projects.

- **G.11. Technical Oversight Committee**. A permanent "Snohomish Estuary Technical Oversight Committee" (SETOC) shall be formed consisting of representatives from agencies approving the "memorandum of agreement" implementing the SEWIP document. The Committee may also invite additional representatives to participate on the Committee. SETOC shall ensure compliance of each development and compensation action with the SEWIP document. SETOC shall act as an advisory committee to the permitting agencies and shall act as a central clearinghouse to provide tracking of impact and compensation acreage created, review and approval of compensation plans, and general technical guidance as requested.

[2] The maintenance bond would be used to ensure restoration goals and objectives are met and may include maintenance actions such as control of invasive species, watering of plants, and maintenance of any installed structures, such as inlet and outlet structures. The contingency bond would be used to provide for correction of design deficiencies identified through monitoring of hydrology, soils and wetland and buffer plantings and ensure attainment of the restoration goals and objectives.

Compensation Policies Specific to "Mudflat" Wetlands

- **M1.** Compensation for impacts to mudflat function[3] within the "mudflat development footprint" found in Ecological Management Units 3 and 5 shall be compensated in EMU 3, 4, or 5.

- **M2.** Compensation for impacts to mudflat functions in the mudflat development footprint in EMU 3 and 5 shall be accomplished by actions consistent with the policies G1 to G11 (excluding policy G8) and M1, and provided that:

    - **M2.1.** A minimum of one acre of intertidal mudflat habitat is restored or created for each acre of intertidal mudflat lost from diking, dredging and/or filling (to -10.0 MLLW).

    - **M2.2.** 0.5 acre of tidal vegetated wetland is created or restored for every acre of delineated vegetated wetland lost through conversion to mudflat habitat. This policy would only apply if delineated vegetated wetland were present within the area to be converted to mudflat habitat.

[3] "Impacts to mudflat functions" for policy M1 and M2 shall be defined as diking, dredging and filling from -10 MLLW and greater in elevation.

Chapter 3 - Description of Natural Resources in Estuary

This Chapter briefly describes the biological and physical resources of the Snohomish Estuary, including vegetation, fisheries and wildlife. Information was drawn from sources which include the 1979 Corps of Engineers Snohomish Estuary Wetlands Study (Shapiro and Associates, 1979), the Snohomish River Wetlands Management Plan (Shapiro and Associates, 1989) and the Port of Everett Landscape Analysis for Port Gardner and the Snohomish River Estuary (Pentec, 1992).

3.1 Description of Physical Elements

The Snohomish Estuary is approximately 9 miles long and 3 to 4.5 miles broad at its widest point, encompassing six major islands within its 19.5 square miles. The Estuary is at the mouth of the Snohomish River and is the second largest Puget Sound watershed, consisting of 1,780 square miles of land and water. Two main tributaries to the Snohomish River, the Skykomish and Snoqualmie, converge at Monroe, Washington, 23 miles upstream from the mouth of the river.

The Snohomish River runs from Monroe to the Estuary at a gradient of 1 ft/mile. The lower portion of the Snohomish River basin is flood protected with a series of levees built and maintained by independent diking and drainage districts.

The average annual runoff is 7,090,000 acre-ft. with an average annual flow of 9,951 cfs measured at Monroe in 1985 (Snohomish Study Team, 1980, and Williams et al., 1985). The maximum discharge for the Snohomish River was measured as 186,000 cfs during the flood of 1990 (Pentec, 1992).

3.1.1 Ecological Management Units (EMU).

The concept of Ecological Management Units (EMUs) is adapted from the *Port of Everett Landscape Analysis, Port Gardner and the Snohomish Estuary* (Pentec, 1992). The original concept combined land use, hydrographic and ecological factors in describing similar areas within the Estuary. For the purposes of developing compensation policies for SEWIP, it was important to separate the existing and restored ecological factors from the current land use conditions. For example, the presence of diked, developed land should not be used to assign a Ecological Management Unit Boundary; rather the conditions that would exist if the area were returned to tidal influence should be used to assign the boundary. Therefore, the current boundaries are based on indicators of the degree of fresh water and marine influence, including plants (vascular and algae) and invertebrates along the tidally influenced Estuary sloughs . To accurately identify the major ecological changes in the Estuary, SETAC conducted a series of comprehensive surveys of the main channels and sloughs from Port Gardner Bay upstream to Highway 2. For systems with predominant marine influence, the presence of eelgrass, brown

algae, sea plantain, seaside arrowgrass, and eastern softshell clam were used in addition to other marine species. For brackish water systems, the presence of Lynby's sedge and Baltic rush were used. For freshwater systems, the presence of skunk cabbage, marsh marigold, reed canary grass and dogwood were used. A detailed description of the process and field observations used in determining EMU boundaries is presented in the May 29, 1996, SETAC minutes in Appendix A, available as a separate document. Figure 3.1 presents the locations of the Ecological Management Units.

EMU 1 - Fluvial Freshwater

EMU 1 generally includes freshwater wetlands in the southern portion of the Estuary. Salt sensitive plant species that distinguish this area include skunk cabbage, yellow marsh marigold, and red osier dogwood. The boundary between freshwater EMU 1 and brackish EMU 2 is located south of Mid-Ebey and Mid-Spencer Islands on Ebey, Steamboat and Union Sloughs and south of the junction of Steamboat Slough on the Snohomish River.

The majority of wetlands within this unit are diked and in agricultural production, with two notable exceptions: Otter Island, which was never diked, and South Spencer Island, which has been restored in part to intertidal influence. Two dead-end sloughs, Deadman and Deadwater, are hydrologically connected to the river. EMU 1 is predominantly within unincorporated Snohomish County, with only the southern tip of Smith Island in the City of Everett's jurisdiction.

River and slough banks are typically steep, consisting of sands with rock rip-rap and occasional pilings present on the Snohomish River. A narrow shoreline of sandy silts (muds) are present throughout most of the EMU.

Historical Condition. Prior to diking, the area was a mosaic of tidal marshes, forested wetlands, sloughs and mudflats that were flooded daily. Agriculture has been the primary land use in this unit, with the exception of log yards and a timber mill on the west side at the Simpson Lee Property. New uses include the City of Everett Waste Water Treatment Ponds and Langus Park on the southern portion of Smith Island.

EMU 2 - Fluvial Brackish Water

EMU 2 generally includes the northern portion of the Estuary east of I-5. The area is comprised of brackish tidal marshes and diked palustrine marshes. Salt tolerant and moderately tolerant plant species in this area include Lyngby's sedge, Baltic rush, seaside arrowgrass and Pacific silverweed. The mid portion of the unit, including Biringer Farm on North Spencer, is in agricultural use.

As in EMU 1, river and slough banks are steep and sandy with rock rip-rap and pilings dominating the banks of the Snohomish River. A narrow shoreline of sandy silts (muds) is present throughout most of the EMU. Wider shoreline mudflats are found primarily along Ebey Slough at lower tides.

This unit differs from EMU 1 in that the majority of the eastern islands (Mid- and North Ebey, and Mid-Spencer) have broken dikes and are subject to tidal influence.

Figure 3.1 Ecological Management Units

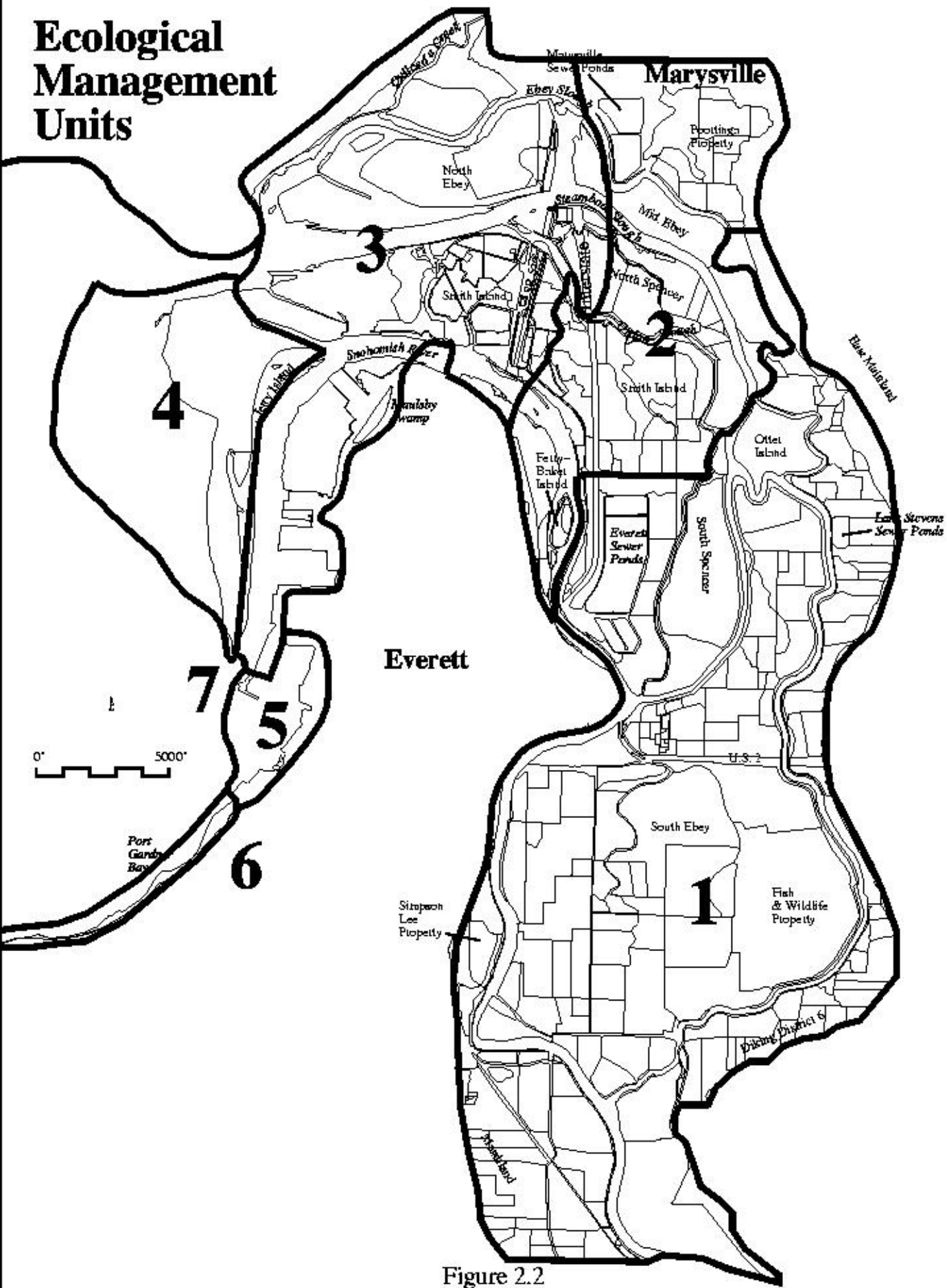

Ecological Management Units
Marysville
Everett
North Ebey
Mid. Ebey
South Ebey
Smith Island
Ebey Slough
Steamboat Slough
North Spencer
South Spencer
Snohomish River
Union Slough
Ebey Island
Hanlaby Swamp
Ferry-Baker Island
Otter Island
Everett Sewer Ponds
Marysville Sewage Ponds
Pootinga Property
Simpson Lee Property
Fish & Wildlife Property
Port Gardner Bay
Tidelands
Dike District 6
U.S. 2
1
2
3
4
5
6
7
0'
5000'

Figure 2.2

Historical Condition. Extensive tidal marshes with a dendritic channel system, interspersed with islands of forested wetlands, dominated this EMU prior to diking. Historical industrial uses in this unit include the closed Weyerhaeuser Mill and the Burlington Northern Railroad delta yard in the southwest portion of the EMU, as well as boat storage and wood chip facilities on Smith Island. The mid portion of the EMU (Biringer Farm on North Spencer) continues to be farmed as it has been historically.

EMU 3 - River and Slough Mouths

This EMU extends southwest along the Quilceda Creek tidal wetlands toward Priest Point, south to the end of Jetty Island and the Naval Station Everett at the Snohomish River mouth, and east to just east of SR 529 on the main river and sloughs. Aquatic habitat consists of a combination of brackish wetlands, saltmarsh and low gradient mud and sand flats. While considerable mixing of river and marine water occurs in this area, the saltwater influence results in the presence of marine species, such as Japanese eelgrass, brown and green algae, and eastern soft shell clam; and the dominance of salt-tolerant plant species, including Lyngby's sedge, Baltic rush, seaside arrowgrass, and seaside plantain.

Relative to EMU 1 and 2, diking is limited and confined primarily to the Snohomish River channel, Smith Island and the area immediately surrounding the Tulalip landfill on North Ebey Island. EMU 3 also includes the industrialized area of the Everett waterfront, extending from Preston Point southward to Naval Station Everett, and the east shore of Jetty Island. The Everett waterfront shoreline has been heavily modified by hard structures, including rock rip-rap, pilings, concrete bulkheads, docks and adjacent roads, parking lots and industrial yards and buildings. In contrast, the undiked portions of the unit at the mouths of Quilceda Creek and Ebey and Steamboat Sloughs are close to the natural historical condition of this part of the Estuary.

Historical Uses. Log storage, pulp and timber mills (such as the closed Weyerhaeuser Kraft Mill) and seaport-related operations were and are major uses in this unit. Other uses have included a torpedo testing pond (west Smith Island) and, more recently, a log yard and a cement mixing facility (Smith Island).

This area has been extensively dredged and filled, primarily for timber related industries, since the inception of the City of Everett. Filling has occurred just south of Preston Point, at the 10th Street boat launch, the North and South marinas, and the Naval Base. It is estimated that this activity has reduced the area of historical mudflats by approximately 50% (Pentec, 1992).

EMU 4 - Delta Flats and Jetty Island

This area encompasses the extensive sand and mudflats of the outer Snohomish River delta and Jetty Island. Small brackish marshes and salt marshes are found on Jetty Island and extensive eelgrass are beds present west of the Island. The shorelines and shallow water areas surrounding Jetty Island are highly productive, supporting many species of fish and invertebrates (Pentec, 1996). A joint Corps of Engineers/Port of Everett project constructed a

2,500-foot-long berm of dredged material on the west side of the island, greatly enhancing habitat for juvenile salmon, surf smelt and shorebirds (Pentec, 1996). Because the area is subject to the waves and currents of Puget Sound and salinities exceeding 30 parts per thousand, it is predominantly marine in character (Cowardin, 1979). Salinities are affected by freshwater flows from the Estuary; however, Jetty Island channels the majority of this flow west of the Island and south into Port Gardner Bay. High river flows during winter months result in significant sediment accretion in this unit.

Historical Uses. The creation of Jetty Island from dredge spoils and material has been the major impact upon this unit. Prior to the creation of Jetty island, this area consisted of intertidal and subtidal sand and mudflats with meandering channels but lacked shoreline and island habitat.

EMU 5 - Deep Water Marine Terminal

This area consists primarily of deepwater and some limited subtidal and intertidal habitat. A small mudflat is located south of the alumina dome, and a broad sand flat lies immediately south of the South Terminal at the mouth of Pigeon Creek #1. This area is primarily marine in nature.

Historical Use. This area has been extensively modified by dredging activities to create a deepwater berth and filling to provide shipping and processing facilities for timber, pulp and aluminum. Prior to alteration this area was probably comprised of beaches consisting of cobbles and mixed sands and silts similar to those that presently line the Mukilteo shoreline to the south.

EMU 6 - Puget Sound/Possession Sound Littoral

This unit includes intertidal beach habitat comprised of cobbles and mixed sands and silts. It stretches from the mouth of Pigeon Creek southwest toward Mukilteo. It also includes Preston Point to the north of Jetty Island and the mouth of the Estuary.

This area is primarily marine in nature but is influenced by flows from the Snohomish River and local streams such as Pigeon Creeks #1 and 2, Merrill and Ring Creeks, Glenwood Creek, Narbeck Creek and Powdermill Creek. Sediment flows from these creeks have created small to moderate sized deltas along this shoreline.

Historical Use. The creation of railroad lines serving the Everett waterfront has extensively modified the shoreline edge. However, the beach areas are still intact and are presently used for passive recreational activities.

3.2 Biological Resources - Habitat Classification

The habitat within the study area was classified according to the Cowardin Classification System (U.S. Fish and Wildlife Service, 1979). Two system classifications were applicable to the study area: estuarine and palustrine. Figure 3.2 presents the dominant vegetation classes for the study area.

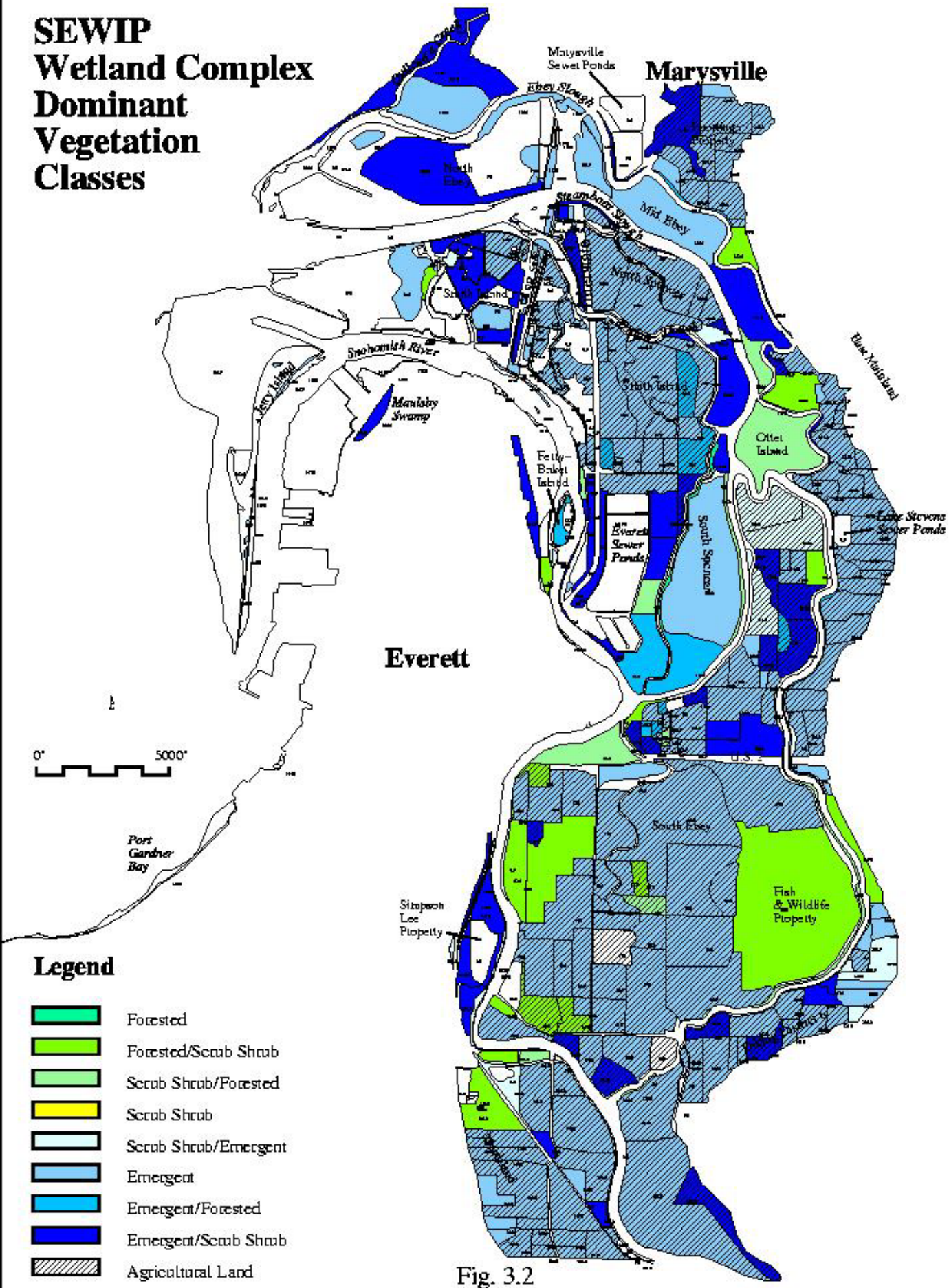

SEWIP
Wetland Complex
Dominant
Vegetation
Classes
Marysville
Everett
Ebey Slough
Steamboat Slough
Snohomish River
Mid Ebey
North Ebey
South Ebey
Smith Island
Ferry-Baker Island
Ottet Island
Jetty Island
Port Gardner Bay
Fish & Wildlife Property
Simpson Lee Property
0'
5000'
Legend
Forested
Forested/Scrub Shrub
Scrub Shrub/Forested
Scrub Shrub
Scrub Shrub/Emergent
Emergent
Emergent/Forested
Emergent/Scrub Shrub
Agricultural Land

Fig. 3.2

Estuarine System

Limits: Upstream and landward to where ocean-derived salts measure less than 0.5% during a period of average annual low flow; and 1) seaward to an imaginary line closing the mouth of river, bay or sound, or 2) the seaward limit of wetland emergents, shrubs, or trees not included in EMU 1, and 3) offshore areas of continuously diluted sea water.

Subsystem: Subtidal; intertidal.

Classes: Rock bottom, unconsolidated bottom, aquatic bed, reef, streambed, rocky shore, unconsolidated shore, emergent wetland, scrub-shrub wetland (<20 ft. high), forested wetland (>20 ft. high).

Wetland Types: Low and high salt marsh, brackish marsh, brackish swamp, mudflat and sandflat.

Location in Study Area: EMUs 2, 3, 4, 5, 6.

Dominant plant species by class observed in Estuary (partial list):

Estuarine Aquatic Bed (western portion of EMUs 3, 4 and 6): *Zostera japonica* (dwarf eelgrass), *Zostera marina* (eelgrass), *Ulva spp*. (sea lettuce), *Fucus gardneri* and *Laminaria saccharina* (brown algae), *Enteromorpha spp.* (green algae).

(In EMU 2): *Callitriche heterophylla* (water chickweed).

Estuarine Emergent (found in EMUs 2, 3 and 4): C*arex lyngbyei,* (Lyngby's sedge)*, Salicornia virginica* (pickleweed), *Jaumea carnosa* (fleshy jaumea), *Deschampsia caespitosa,* (tufted hairgrass)*, Hordeum bracyantherum* (meadow barley)*, Distichlis spicata* (saltgrass)*, Plantago maritima* (seaside plantain), *Potentilla pacifica* (Pacific silverweed) S*cirpus acutus/validus* (hard stem and soft stem bulrush)*, Scirpus americanus* (three square bulrush)*, Scirpus maritimus* (seacoast bulrush)*, Triglochin maritimum* (seaside arrow grass)*, Typha angustifolia* (narrow leaf cattail), *Typha latifolia* (common cattail)*, Orthocarpus castillejoides* (paintbrush owl-clover), *Lilaeopsis occidentalis* (western lilaeopsis), *Aster subspicatus* (Douglas aster), *Grindelia integrifolia* (Puget Sound gum weed), *Atriplex patula* (saltbrush), *Heracleum lanatum* (cow parsnip), *Crepis spp.* (hawksbeard).

Estuarine Scrub-Scrub (EMU 2 and scattered locations in EMU 3): *Lonicera involucrata* (black twinberry), *Rosa nutkana* (Nootka rose), *Physocarpus capitatus* (Pacific ninebark), *Malus fusca* (crabapple), *Rubus spectabilis* (salmonberry), *Spiraea douglasii* (hardhack spirea).

Estuarine Forested (EMU 2): *Picea sitchensis* (sitka spruce).

Palustrine System

Limits: All nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens and all such wetlands that occur in tidal areas where salinity due to ocean salts is less than 0.5%.

Subsystems: None

Classes: Rock bottom, unconsolidated bottom, aquatic bed, unconsolidated shore, moss-lichen wetland, emergent wetland, scrub/shrub wetland, forested wetland.

Wetland Types: Freshwater marsh, wet meadow, bogs, freshwater swamps.

Location in Study Area: EMUs 1 and 2, and the eastern portion of EMU 3.

Dominant plant species by class observed in Estuary EMU (partial list):

Aquatic Bed Emergent, Tidal (Primarily found in EMU 1): *Callitriche heterophylla* (water chickweed), *Nuphar luteum* (yellow pond lily).

Palustrine Emergent, Tidal (Primarily found in EMU 1): *Lysichiton americanum* (skunk cabbage), *Phalaris arundinacea* (reed canary grass), *Carex obnupta* (slough sedge), *Typha latifolia* (common cattail), *Caltha palustris* (yellow marsh-marigold), *Athyrium felix-femina* (lady fern), *Alisma plantago-aquatica* (broadleaf water plantain), *Sagittaria latifolia* (duck potato), *Oenanthe sarmentosa* (water parsley), *Veronica spp.* (speedwell), *Polystichum munitum* (sword fern).

Palustrine Scrub-Shrub, Tidal (Primarily found EMU 1): *Cornus sericea* (red-osier dogwood), *Rosa nutkana* (Nootka rose), *Physocarpus capitatus* (Pacific ninebark), *Malus fusca* (crabapple), *Rubus spectabilis* (salmonberry), *Spiraea douglasii* (hardhack spirea).

Palustrine Forested, Tidal (Primarily found in Management EMU 1): *Salix lasiandra* (Pacific willow), *Salix scouleriana* (Scouler's willow), *Picea sitchensis* (Sitka spruce), *Populus trichocarpa* (black cottonwood), *Thuja plicata* (western red cedar), *Alnus rubra* (red alder), *Rhamnus purshiana* (cascara).

Palustrine Aquatic Bed, Non Tidal (Primarily found in EMU 1): *Potamogeton spp.* (pondweed), *Myriophyllum spicatum* (Eurasian water milfoil), *Lemna minor* (duckweed).

Palustrine Emergent, Non-Tidal (Primarily found in EMU 1 and 2): *Lysichiton americanum* (skunk cabbage), *Carex deweyana* (Dewey's sedge), *Carex obnupta* (slough sedge), *Typha latifolia* (common cattail), *Sparganium spp.* (burreed), *Athyrium felix-femina* (lady fern), *Alisma plantago-aquatica* (broadleaf water plantain), *Oenanthe sarmentosa* (water parsley), *Veronica spp.*(speedwell), *Iris pseudacorus* (yellow iris), *Tolmiea menziesii* (piggyback plant), *Juncus ensifolius* (dagger-leaf rush), *Impatiens noli-tangere* (yellow touch-me-not), *Eleocharis spp* (spikerush), *Glyceria spp.* (mannagrass), *Urtica dioica* (stinging nettle), *Solanum dulcamara* (bittersweet nightshade).

Palustrine Emergent Non-Tidal On Agricultural Lands (Primarily found EMUs 1, 2 and 3): *Phalaris arundinacea* (reed canary grass), *Festuca spp*. (fescue), *Holcus lanatus* (common velvetgrass), *Agropyron spp.* (wheatgrass)*, Alopecurus spp.* (foxtail), *Juncus effusus,* (soft rush)*, Dactylis glomerata* (orchard grass)*, Agrostis spp* (bentgrass), *Poa spp.* (bluegrass), Gly*Epilobium angustifolium* (fireweed)*, Melilotis alba* (white sweet clover), *Ranunculus repens (*creeping buttercup*), Phleum pratense* (timothy)*, Cirsium arvense* (Canadian thistle)*, Cirsium vulgare* (bull thistle), *Polygonum sp.* (knotweed), *Chenopodium album* (lambs quarters).

Palustrine Scrub-Shrub, Non-Tidal (Primarily found in EMUs 1 and 2): *Cornus sericea* (red-osier dogwood), *Rosa nutkana* (Nootka rose), *Lonicera involucrata* (black twinberry), *Physocarpus capitatus* (Pacific ninebark), *Oemleria cerasiformis* (Indian plum), *Spirea douglasii* (hardhack spirea), *Salix sp*p (willow), *Malus fusca* (crabapple), *Sambucus racemosa* (red elderberry), *Rubus procerus* (Himalayan blackberry).

Palustrine Forested, Non-Tidal (Primarily found in EMUs 1 and 2): *Salix lasiandra* (Pacific willow), *Salix scouleriana* (Scouler's willow), *Picea sitchensis* (Sitka spruce), *Populus tricocarpa* (black cottonwood), *Thuja plicata* (western red cedar), *Alnus rubra* (red alder), *Pinus contorta* (lodgepole pine), *Acer macrophyllum* (big-leafed maple).

3.3 Fish Resources

The following summary of fisheries resources is from Pentec (1992), Simenstad et al. (1982) and the National Marine Fisheries list of species. For more information, consult these references.

3.3.1 Salmonid Fish. The Estuary supports runs of seven salmonids: coho (*Oncorhynchus kisutch*), chum (*Oncorhynchus keta*), pink (*Oncorhynchus gorbuscha*), chinook (*Oncorhynchus tshawytscha*), sea-run cutthroat (*Oncorhynchus clarki*), steelhead (*Oncorhynchus mykiss*), and Dolly Varden (*Salvelinus malma*). All of these species are important in recreational fisheries, and five are important commercial and Native American fisheries. All species spawn in freshwater upstream of the Estuary. Spawning varies from August and September for pink and Chinook salmon to May through June for steelhead and cutthroat trout.

Upstream migration of adult salmonids occurs every month of the year, mostly in August through March. Migrating salmon pass through all of the Estuary, most fish moving quickly to upstream holding and spawning areas. By the time adult salmon and steelhead enter the Estuary, most have stopped active feeding. The smaller adult sea-run cutthroat trout and Dolly Varden, however, actively feed in the lower river channels and shorelines throughout the Estuary where favorable habitats are found.

Downstream smolt migration occurs mainly in the spring and early summer. Estuarine habitats provide a transition zone where juvenile salmonids physiologically adapt from fresh to salt water environments. The Estuary also provides habitats for feeding and refuge from predation. In many cases, the growth rates for juvenile salmonids in estuaries may be the highest in their life histories. In addition, the Estuary is an important source of primary production for the food chain that supports salmonids, as well as other species.

The extent of estuarine wetland use by juvenile salmonids for feeding and refuge varies among the species. Pink salmon smolts tend to move quickly through the Estuary, concentrating along the shorelines and feeding on small crustaceans and insects. Upon entering the more marine environment of the lower Snohomish River channel, the delta flats, and Port Gardner Bay, pink smolts continue to feed along shorelines, moving rapidly into offshore waters as they grow.

In contrast, chum salmon smolts may remain in the Estuary up to four or five weeks before entering Port Gardner Bay, moving in and out of wetlands with the tide and feeding extensively on copepods and insects. Once they enter Port Gardner Bay, they migrate along the shoreline, but tend to move offshore as they grow, concentrating at the offshore margins of piers and wharves and switching from a benthic to pelagic diet.

Snohomish Estuary wetlands provide insect and crustacean prey for chinook salmon smolts as they migrate through the Estuary, often moving into the wetlands on the flood tides. Chinook salmon residency times within lower riverine and estuarine environments range from six to 189 days. Sub-yearling chinook smolts spend several weeks in the Port Gardner area using both near shore and deep water habitat, while the larger yearly smolts move directly into off-shore areas.

Coho salmon are typically considered one of least shoreline-associated species of juvenile Pacific salmon; however, individual residency times for yearling coho smolts within estuarine habitats may range from 6 to 40 days. Coho pre-smolts were found using the marsh on Mid-Ebey Island for up to six weeks in a recent study. Coho smolts in the main channels feed on small freshwater crustaceans and insects. Coho smolts disperse rapidly upon entering Port Gardner and feed almost exclusively on pelagic prey, including juvenile fishes.

Sea-run cutthroat trout, steelhead trout, and Dolly Varden are present in the Estuary and Port Gardner Bay in lesser numbers than the Pacific Salmon. Relatively little is known regarding their residence periods and habitat utilization of estuarine areas for these salmonids.

3.3.2 Non-Salmonid Fish: The Snohomish Estuary. Juvenile starry flounder (*Platichthys stellatus*) is the most widely distributed and abundant non-salmonid fish species within the Estuary. Primarily a marine/estuarine species, it is found on a variety of substrates and spawns in marine waters at depths greater than 45 meters. Peamouth chub (*Mylocheilus caurinus*), the second most abundant non-salmonid Estuary species, is also widely distributed throughout the Estuary. This species spawns on a gravel or rubble substrate and adults are frequently found in off-channel areas. Also widely distributed in the study area, the Pacific staghorn sculpin (*Leptocottus armatus*) is the third most abundant non-salmonid species in the Estuary. Prickly sculpin (*Cottus asper*) is relatively abundant in EMUs 1 and 2. Three-spined sticklebacks (*Gasterosteus aculeatus*), shiner perch (*Cymatogaster aggregata*), juvenile smelts and lampreys are also found in the study area. Less abundant species include candlefish (*Thaleichthys pacificus*), Pacific herring (*Clupea pallasi*) and pumpkinseed (*Lepomis gibbosus*).

3.3.3 Non-Salmonid Fish: Port Gardner and Possession Sound. Starry flounder and English sole (*Parophrys vetulus*) are common flatfish in these areas. Surf smelt (*Hypomesus pretiosus*) and sand lance (*Ammodytes hexapterus*) are both very important forage fish that are abundant in shallow waters of EMUs 3,4, 5 and 6. Numerous other species, typically associated with estuarine habitats for at least part of their life history, are also found in Port Gardner. These

species include: tadpole sculpin (*Enophrys bison*), striped seaperch (*Embiotoca lateralis*), Pacific tomcod, (*Microgadus proximus*in), saddleback gunnel (*Pholis ornata*), sand sole (*Psettichthys melanostictus*), Pacific hake (*Merlucclus productus*), walleye pollock (*Theragra chalcogramma*), copper rockfish (*Sebastes caurinus*), spiny dogfish (*Squalus acanthias*), snake prickleback (*Lumpenus sagitta*), and bay goby (*Lepidogobius lepidus*).

3.4 Invertebrate Resources

Invertebrate Species by EMU

A number of invertebrate species are present in the Snohomish River Estuary, according to Pentec, 1992. Invertebrate species data are available only for EMUs 3, 4, 5 and 6.

Common species present in EMUs 3, 4, 5 and 6 include: snails (*Littorina* spp.), mussels (*Mytilus* cf. *edulis*), clams (*Macoma balthica, Macoma* spp*., Cryptomya* spp.), cockles (*Clinocardium sp*.), jingle shells (*Pododesmus macroschisma*), polychaetes (*Nereis* spp., *Notomastus* spp., *Nephtys* spp., *Glycera* spp.), barnacles (*Balanus glandula*), shore crabs (*Hemigrapsus* spp.), isopods (*Gnorimosphaeroma oregonensis*), ghost shrimp (*Callianassa* sp.), blue mud shrimp (*Upogebia pugettensis*), Dungeness crab (*Cancer magister*), and red crab (*Cancer productus*). Anemones (*Mertridium senile*) are present in EMUs 3, 5 and 6 (Pentec, 1992).

Of these invertebrate species, Dungeness crab is the most significant commercially and is considered a priority species because of the limited habitat available in both the Everett area and Puget Sound.

A more detailed list of invertebrate species expected to be found in, or in the vicinity of, the study area is located in Appendix G, available as a separate document.

Species Use of Substrate

Invertebrate species in the Snohomish River Estuary are associated with specific substrate types: floats and pilings, rocky or artificial hard substrate, mixed-coarse, mixed-fine, sandflats, mudflats/mudbanks, and shallow subtidal/soft bottom.

Some floats and numerous pilings are found in the Estuary. Pilings are used for rafting logs or are abandoned and are present in EMUs 3, 4, 5 and 6. Rocky and artificially hard substrate is also found in EMUs 3, 4, 5, and 6. Artificial hard substrate can take the form of bulkheads or rip-rap. Mixed-coarse substrate is present in EMUs 3, 4, and 5. Mixed-fine, sandflats, mudflats/mudbanks, and shallow subtidal/soft bottom substrates are all present in EMUs 3, 4, 5 and 6.

Anemones are associated with pilings and rocky substrates. Snails, shore crabs and isopods are associated with rocky, mixed-coarse and mixed-fine substrates. Mussels are associated with pilings, rocky, mixed-coarse and mixed-fine. Clams are associated with mixed-fine, sandflats, mudflats, and shallow subtidal/soft bottom. Cockles are associated with sandflats. Polychaetes are associated with mixed-fine, mudflats/mudbanks and shallow subtidal/soft bottom. Barnacles are associated with pilings, rocky, mixed-coarse and mixed fine. Ghost shrimp are associated with sandflats and mudflats/mudbanks. Blue mud shrimp are associated

with mudflats/mudbanks. Dungeness crab are associated with pilings, rocky, sandflats, mudflats/mudbanks, and shallow subtidal/soft bottom. Red crab are associated with pilings, rocky, mixed-fine, sandflats, and shallow subtidal/soft bottom (Pentec, 1992).

3.5 Wildlife Resources

This section summarizes wildlife resources in the Snohomish Estuary. A detailed wildlife analysis of the Estuary based on existing information is available in Appendix G, available as a separate document. Appendix G includes a qualitative analysis of Snohomish Estuary wildlife habitat using rapid assessment techniques of landscape ecology, geographic information systems, interviews with local wildlife specialists, and the most up-to-date biological survey information available. The wildlife analysis does not include a quantitative assessment of wildlife usage in the Snohomish Estuary.

The Snohomish Estuary is important as wildlife habitat on several geographic scales. Estuary habitats function locally as a corridor/refuge within the lower Snohomish River watershed for small mammals, herptiles, and invertebrates and function regionally in the extended Snohomish River basin for medium and large mammals and birds. The Estuary links urban and rural open space from the Puget Sound lowlands to the Cascade Crest. Estuary wetland habitats also function regionally, nationally and internationally as a stop-over and wintering area in the Pacific Flyway for migratory waterfowl, including ducks, geese, and swans; and neotropical migrants, such as certain passerines and raptors. Diking District 6 within the Estuary has been recognized as an a important area for restoration in the Washington State Component of the North American Waterfowl Management Plan.

Compared to other Puget Sound estuaries, the Snohomish Estuary is one of the most diverse in habitat types and wildlife species (Carroll personal commuication with Rick Huey, 1996). Key aquatic habitats include: subtidal unvegetated and vegetated (eel grass); intertidal mudflat and eel grass; salt and brackish marsh; and fresh water emergent, scrub/shrub and forested wetlands and riparian habitats. Forest fringe habitats of spruce and alder on and adjacent to the dikes provide important migration habitat for mammals and birds and have considerable fish value where overhanging riparian vegetation is present. Seasonally flooded agricultural lands in association with the Estuary provide waterfowl and shorebird feeding and refuge habitat (Zeigler personal communication, 1996).

A variety of rare and uncommon species is present in addition to large numbers and diversity of common species. During the field inventory process for SEWIP (May through October 1994), 63 species of birds, 15 species of mammals, and four species of herptiles were observed in the Estuary. During a 1978 to 1980 U.S. Fish and Wildlife study of the Estuary, a total of 116 species of migratory and resident birds was identified (Zeigler, 1996). An example of the large numbers of individuals using the Estuary is provided by a 1980 survey where 17,524 ducks and geese were recorded in a single day.

Of the 62 “wetland associated” Priority Species listed by the state, approximately 40 occur in the Estuary (Priority Habitat and Species Program - WDFW 1993). The status of these species ranges from federally endangered or threatened to state monitor (surveillance of a given species). Figures 3.3 and 3.4 show generalized PHS observations in the Snohomish Estuary.

3.5.1 Birds. The Snohomish Estuary is a staging and stop-over area for bird migration along the West Coast Flyway. Snohomish Estuary habitats are also important to Puget Sound and resident bird populations.

3.5.2 Birds Associated with Marine Areas. The lower Estuary supports a variety of marine birds, waterbirds, waterfowl, and raptors. Observed species in EMUs 3 and 4 include red-breasted mergansers, loons, goldeneyes, scoters, western grebes, cormorants, pigeon guillemots, brants, eagles, ospreys, peregrines, merlins, gulls, and terns (Carroll & Pentec, 1992). Most species are more common in the winter than in other seasons of the year. The SEWIP field team counted over 60 active cormorant nests on a row of old pilings near the mouth of Union Slough during the summer of 1994. Ospreys also nest on pilings, with about 15 nests located in the lower Estuary (Meehan-Martin personal communication, 1996). Marbled murrelets use Port Gardner Bay and Possession Sound for foraging (Carroll personal communication, 1996).

3.5.3 Waterbirds . The Snohomish Estuary is recognized as regionally important for shorebirds. Shorebirds use the Estuary during both the spring and fall migrations, and some species are there almost all year long. Spring migration is dominated by shorebirds and fall migration by waterfowl and raptors. During spring migration the number of shorebirds passing through the Estuary is greater than during the fall migration, but there are fewer species except on Jetty Island (Carrol, 1992). Dunlin[1] and western sandpipers are the most common species in the spring. Bairds, sharp-tailed and pectoral sandpipers, and golden plovers, though uncommon, are sometimes observed during fall migration. Dowitchers, dunlin, black-bellied plovers, western sandpiper, and yellow-legs are common both spring and fall (Meehan-Martin personal communication, 1996).

Because shorebirds feed on benthic invertebrates in fine sediment and mud, several mudflats within the study area are used heavily by shorebirds[2]. This includes: the Maulsby Mudflats, especially the area directly north of the 10th Street Boat Launch, which is shallower and has less log rafting activity than the rest of the flats; the Jetty Island berm and west Jetty Island where 18 species of shorebirds have been observed and over 8,700 individuals were reported on April 27, 1995 (Pentec, 1996); South Spencer Island, where more than 50 western sandpipers at a time have been observed (Carroll personal communication, 1996); and the mudflat area south of the barges (breakwater) at the mouth of the Estuary. The recent construction of Naval Station Everett and has eliminated the Caspian and Artic tern colonies in the Estuary and significantly reduced the number of the Caspian terns present.

Other waterbirds common throughout the Estuary are American bittern, sora (breeding season), wintering common snipe, Virginia rails and greater yellowlegs. Fourteen Virginia rails were observed at Spencer Island during the 1995 Christmas Bird Count.

[1] Though most common on marine mudflats, they have also been seen on the Spencer Island mudflats (Meehan-Martin, pers. com. 1996).

[2] Shorebird use is keyed to the tidal cycles - as the tide rises they condentrate on uncovered mudflats to forage, then spread out in the Estuary when the tide drops (Meehan-Martin, pers. com. 1996).

3.5.4 Waterfowl. A wide variety of waterfowl use the Estuary[3] including Northern shovelers, American coots, ruddy ducks, northern pintails and several species that breed in the Estuary, including Canada geese, mallards, and gadwall. The flooded agricultural pastures and fields in EMUs 1 and 2 provide significant over-wintering habitat for thousands of dabbling ducks and several trumpeter swans. Great blue heron use the drier portions of agricultural fields when higher tides reduce hunting opportunities outside of the dikes (Meehan-Martin personal communication, 1996). A flock of snow geese and a rare emperor goose have been reported along the lower Snohomish Channel (Pentec, 1996).

Brant feed on the abundant eel grass west of Jetty Island (100 to 290 individuals in January through March). Over 25 species of waterfowl that have been observed on and just off shore of Jetty Island including American wigeon (1,000-3,000 in October/November peak) which use the west shore of Jetty Island as a resting place at night (Carroll personal communication, 1996; Pentec, 1996).

3.5.5 Raptors. Raptor species are widely dispersed throughout the Estuary habitats, including mudflats, emergent marshes, agricultural fields and forested swamps. Species that nest in the Estuary include red tail hawks, northern harriers, ospreys, Cooper's hawks, great horned owls, screech owls, and bald eagles.

Bald eagles use the Estuary due to the abundance of food available on the mudflats. Seven nesting pairs are confirmed in the Estuary, with two additional pairs that may be present (Carroll, 1996; Carroll & Pentec personal communication, 1992). Eagles prey on gulls and probably on stranded fish and crabs in the Estuary mudflat areas. Eagles occur year around on mudflats, with the highest concentration occurring during April through June, due to the presence of sub-adults[4].

Osprey have been observed in the brackish marsh areas of the Estuary, including southern EMU 2 and northern EMU 1, but are more common in the marine areas, where they nest on pilings. Peregrine falcons are present most of the year in the lower Estuary and prey on shorebirds, waterfowl and gulls (Carroll, 1996). An occasional turkey vulture, which is a cliff nester and comes from upland forested areas, has been seen scavenging in the Estuary (Meehan-Martin, 1996).

Seasonally flooded agricultural fields attract northern harriers, red-tail hawks, peregrine falcons, rough-legged hawks and merlin. The northern harriers, red-tail hawks and rough-legged hawks primarily hunt small mammals while peregrine falcons prey on shorebirds, waterfowl and gulls and merlins on smaller birds. Cooper's hawk, and sharp-shinned hawk find refuge in the hedgerows and forested areas in the Estuary (Meehan-Martin, 1996).

3.5.6 Passerines. Warblers and passerines migrate through the Estuary in the spring and fall, traveling as far north as Alaska[5]. In the Estuary, they are attracted to riparian corridors, scrub/shrub, and forested habitat. Because much of the riparian vegetation has been

[3] Many of the species are concentrated at the Everett Waste Water treatment ponds and South Spencer Island

[4] Up to 20 sub-adult eagles, and seven adult eagles have been observed using the mudflats west of Jetty Island at one time during the breeding season.

[5] Internationally, neo-tropical migrant numbers are plummeting due to loss of habitat and other factors.

eliminated along Estuary waterways, the remaining riparian corridors support significant numbers of passerines. Numerous warblers have been observed at Spencer and Smith Islands in the riparian vegetation along the public access paths. Marsh wrens are common, as are red-winged blackbirds. Uncommon species include the Harris' sparrow and a nesting pair of purple martins near the 10th Street Boat Launch [6].

3.5.7 Mammals. River otters, minks, muskrats, weasels, beavers, coyotes, raccoons, and deer are all common throughout the Estuary. Larger mammals such as cougar or bear are rarely observed in the Estuary. This reflects loss of upland habitat, loss of forested habitat within the Estuary, and loss of corridors connecting the Estuary to upland habitat.

Jetty Island observations include coyote (which cross over from Smith Island on the mudflats at low tide), river otter, Townsend's voles, and rats. Marine mammals in the Estuary include California and Stellar sea lions and harbor seals (Carroll, 1996). A recent aerial survey resulted in a count of 689 California sea lions on the East Waterway log boom adjacent to the Navy pier in March 1995 (D. Lambourn, WDFW Marine Mammal Investigations EMU, Tacoma, WA).

[6] Nest boxes have been placed at the 10th Street Boat Launch area, Langus Park, and Lowell Riverfront Park; a pair was observed carrying nesting material into one of the nest boxes in July 1996 (Carroll personal communication, 1996).

Chapter 4 - Analysis of Assessment Data and Ranking of Wetland Complexes

Summary

Analysis of the assessment data indicates that 71% of the Estuary's area of vegetated wetlands and 89% of the Estuary's area of mudflats have a moderate to high level of performance of the Wildlife and Water Quality Improvement Functions (Group 1 and 2 Wetland Complexes). The remaining 29% of area in the Estuary for vegetated wetlands is performing at a lower level for wetland functions, but has a high potential for restoration because hydric soils are still present and hydrology can be readily provided. As such, the Estuary is functioning as an integral ecosystem and has high potential for successful restoration given the presence of hydric soils, hydrology and ample adjacent "pristine" sites which could serve as sources for plant and animal colonization.

The Water Quality Improvement, Wildlife, and Social Significance Attribute assessment scores for 367 wetlands within the Snohomish Estuary are presented in Figures 4.1 through 4.4.3. While Figures 4.1 and 4.2 depict the wetland performance scores for Wildlife and Water Quality Attributes, respectively, Figure 4.3 shows the location of Group "1, 2 and 3" wetland complexes based on a combination of these attributes. The three wetland groups were developed from analysis of the frequency distribution of data for each of the three attributes and from the habitat assessment model (IVA).

The IVA model used only one of 3 scores (1, 2 or 3) for each of the 138 indicator questions that were applied to each wetland assessed. The model scores of 1, 2 or 3 were assigned by Technical Committee based on their professional judgment as to whether an indicator was "weakly, strongly or very strongly associated with the performance of a functions." For example, a wetland with a constrained outlet would be "very strongly associated" (score of 3) with the performance of the Water Quality Improvement Function, and one with an unconstrained outlet would be only "weakly associated" (score of 1). This same numerical basis was applied to the development of the three Wetland Groups.

The frequency distribution analysis involved selecting breaks in the data where three distinct clumps or "groupings" of wetland scores occurred. For example, the group of highest scoring wetlands (**Group 1**) is assumed to have the highest performance of wetland functions because more of the indicator questions of the habitat assessment model (IVA) would have received the highest individual score of "3" for those wetlands relative to other wetlands. The score of 3 in the model meant that an indicator "was very strongly associated with the performance of the function" that was being scored. Therefore, a **Group 1** wetland complex is "very strongly associated with the performance of Estuary functions."

The same logic was applied to both the **Group 2** and **Group 3** wetlands. The middle group of wetlands in the frequency distribution was assumed to have the second highest level of performance because more of the indicator questions for the IVA model would have received

the individual score of “2” relative to other wetlands. The score of 2 in the IVA model meant that an indicator “was strongly associated with the performance of the function” being scored. Therefore, a Group 2 wetland complex is “strongly associated with the performance of Estuary functions.”

The lowest scoring group of wetlands in the frequency distribution was assumed to have the lowest level of performance because more of the indicator questions for the IVA model would have received the individual score “1” relative to other wetlands. The score of “1” in the model meant that an indicator was “weakly associated with the performance of the function” being scored. Therefore, a **Group 3** wetland complex is “weakly associated with the performance of Estuary functions.”

The individual Social Significance functions were not combined into a final overall categorization because of the dissimilar nature of "transportation access" and "recreation/aesthetics" functions. Therefore, a separate map of Wetland Groups is shown for each Social Significance function. Appendix C presents the IVA data set used to calculate IVA scores and the frequency distributions of IVA data.

The following sections first examine the ranking of the wetland complexes, then their classification into Group 1, 2 or 3 wetland complexes. Any use of the terms "high-, medium- or low-ranking" is strictly to note the ranking range within which a wetland complex falls. It should be noted that wetland rankings ***should not be compared between*** mudflat (non-vegetated) wetland complexes and vegetated wetland complexes due to the different indicator assessment models used for each wetland type. In figures 4.1 to 4.3, non-vegetated wetlands are shaded within the brown color range.

4.1 Ranking of Wildlife Attribute Scores

The functions within the Wildlife Attribute included: mammal habitat, anadromous fish habitat, non-anadromous fish habitat, nesting bird habitat, overwintering bird habitat, migratory bird habitat, invertebrate habitat, and herptile (amphibians and reptiles) habitat.

Figure 4.1 demonstrates that the Estuary presently has a relatively continuous area of high- to medium-ranked wetland complexes that stretches from the western mudflats along the outer northern and eastern edge through Otter Island and then to the north end of South Ebey immediately south of Highway 2.

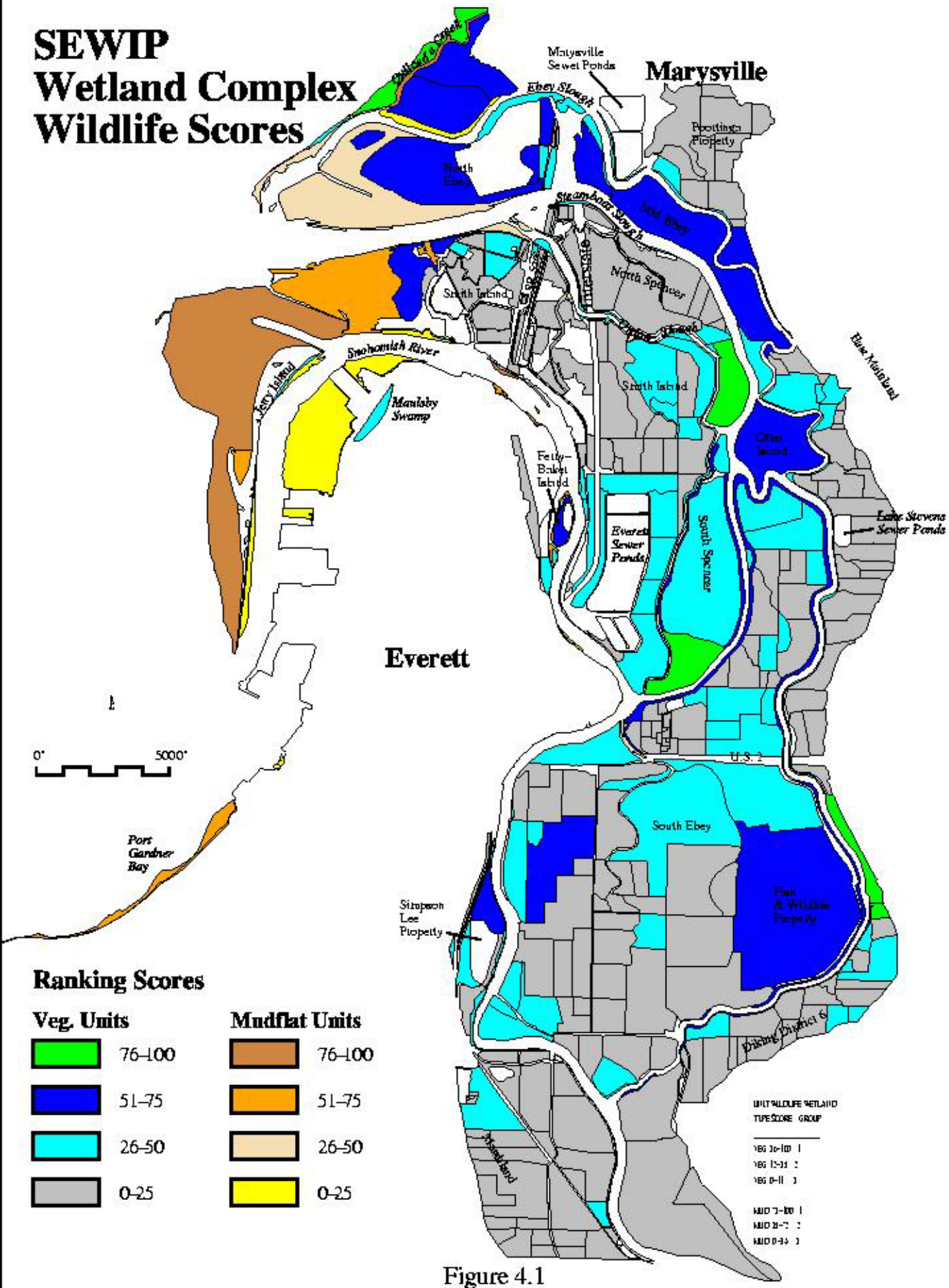

SEWIP
Wetland Complex
Wildlife Scores
Marysville
Everett
Ranking Scores
Veg. Units
76–100
51–75
26–50
0–25
Mudflat Units
76–100
51–75
26–50
0–25
0'
5000'
Snohomish River
Ebey Slough
Steamboat Slough
Union Slough
Quilceda Creek
Marysville Sewer Ponds
Pootinga Property
North Ebey
South Ebey
North Spencer
South Spencer
Smith Island
Jetty Island
Manilaby Swamp
Ferry-Baker Island
Everett Sewer Ponds
Cable Island
Lowell
Port Gardner Bay
Simpson Lee Property
U.S. 2
Pond
Mainland

Figure 4.1

Wetland complexes ranking greater than "50" for the Wildlife Attribute were concentrated on Ebey and Steamboat Sloughs and Quilceda Creek in the northwestern, north and northeast portions of the Estuary and on the mudflats west of West Smith Island and Jetty Island.

The areas with wetlands scoring in the highest-ranking Group (76 to 100) are the forested freshwater tidal wetland north of Drainage District 6, the freshwater tidal wetland on the south end of South Spencer, Mid-Spencer, and the emergent wetland lining Quilceda Creek in the northern portion of the study area.

The lower-ranking wetlands consist primarily of agricultural lands and undeveloped "mowed" lands within industrial areas. These lower ranking areas predominate in the Estuary for the wildlife attribute.

The general list of wetlands ranking greater than “50” for the Wildlife Attribute includes:

Tidal (Estuarine) Wetlands:

1) The large tidal mudflat directly west of Jetty Island and smaller mudflats along Quilceda Creek, the north edge of West Smith Island (WC 172), and the Snohomish River beneath the SR 529 bridge and surrounding Ferry-Baker Island;

2) The large emergent tidal wetlands on Quilceda Creek, West Smith Island, North and Mid-Ebey, Mid-Spencer directly south of the cultivated portion of Biringer farm, and South Spencer (southern tidal portion);

3) The forested/scrub-shrub/emergent tidal wetlands on Otter Island, Mid-Ebey directly north of Otter Island, the East mainland directly east of Mid-Ebey Island, on Ferry Baker Island in the Snohomish River, north portion of South Spencer (partial tidal), east mainland directly south of Highway 2 adjacent to Ebey Slough, and the north portion of Simpson-Lee property (partial tidal);

4) The forested/scrub-shrub/emergent tidal "edge wetlands" on South Spencer, and the north portion of South Ebey immediately north of Highway 2 and continuing along Ebey Slough south of Highway 2;

Palustrine (Non-tidal) Wetlands

5) The large forested palustrine wetlands (diked) on the west and east (Fish and Wildlife Property) side of South Ebey Island.

4.2 Ranking of Water Quality Improvement Attribute Scores

The Water Quality Improvement Attribute includes the sediment retention, toxicant retention and nutrient retention functions. Figure 4.2 demonstrates that wetlands which ranked greater than "50" for the Water Quality Improvement Attribute are more predominate in the Estuary than wetlands in the same score range for the Wildlife Attribute. These higher-ranked wetland complexes are concentrated in the west, and southward along Steamboat Slough to its

confluence with the Snohomish River by South Spencer Island. A second and third concentration of wetlands ranking higher than “50” were located on south Ebey Island on Ebey Slough (Fish and Wildlife Property) and in Marshland along the Burlington Northern railroad line.

The largest area of top-ranked "vegetated” tidal wetland complexes was located in the northern portion of the study area by Quilceda Creek. The largest area of highest-ranked "non-vegetated" tidal wetland complexes was located off the west edge of Smith and North Ebey Islands.

Wetland complexes with medium- to high-ranking Water Quality Improvement Attribute scores (26 to 100) covered a much larger area of the Estuary than those with medium- to high-ranking Wildlife Attribute scores. This indicates that the Water Quality Improvement functions are at a higher level of performance uniformly throughout the Estuary than the Wildlife Attribute functions.

A general list of wetlands ranking greater than “50” on Water Quality Improvement Attributes functions includes:

Tidal (Estuarine) Wetlands

1) Mudflats immediately west of the mouths of Ebey, Steamboat, Union Sloughs and the mouth of the Snohomish River (water quality rankings for mudflats should not be compared to rankings for vegetated wetlands) and west of Jetty Island;

2) Emergent tidal wetlands on Quilceda Creek, Maulsby Swamp, North Ebey, west fringe of West Smith Island, Mid-Ebey Island, Mid-Spencer, South Spencer and the north portion of Simpson Lee; and

3) Forested/scrub-shrub/emergent tidal wetlands on Otter Island, the west portion of South Ebey immediately north and south of Highway 2, and on Ferry Baker Island.

Palustrine (Non-tidal) Wetlands

4) Large forested/scrub-shrub wetlands on south Ebey on the west and east sides including the Fish and Wildlife Property (west side) and immediately north of Highway 2 on the west side of South Ebey Island;

5) Medium sized forested/scrub-shrub wetland on the west mainland located in the Marshland area and in Drainage District 6; and

6) Smaller emergent wetlands located in the vicinity of the Marshland District and Drainage District 6.

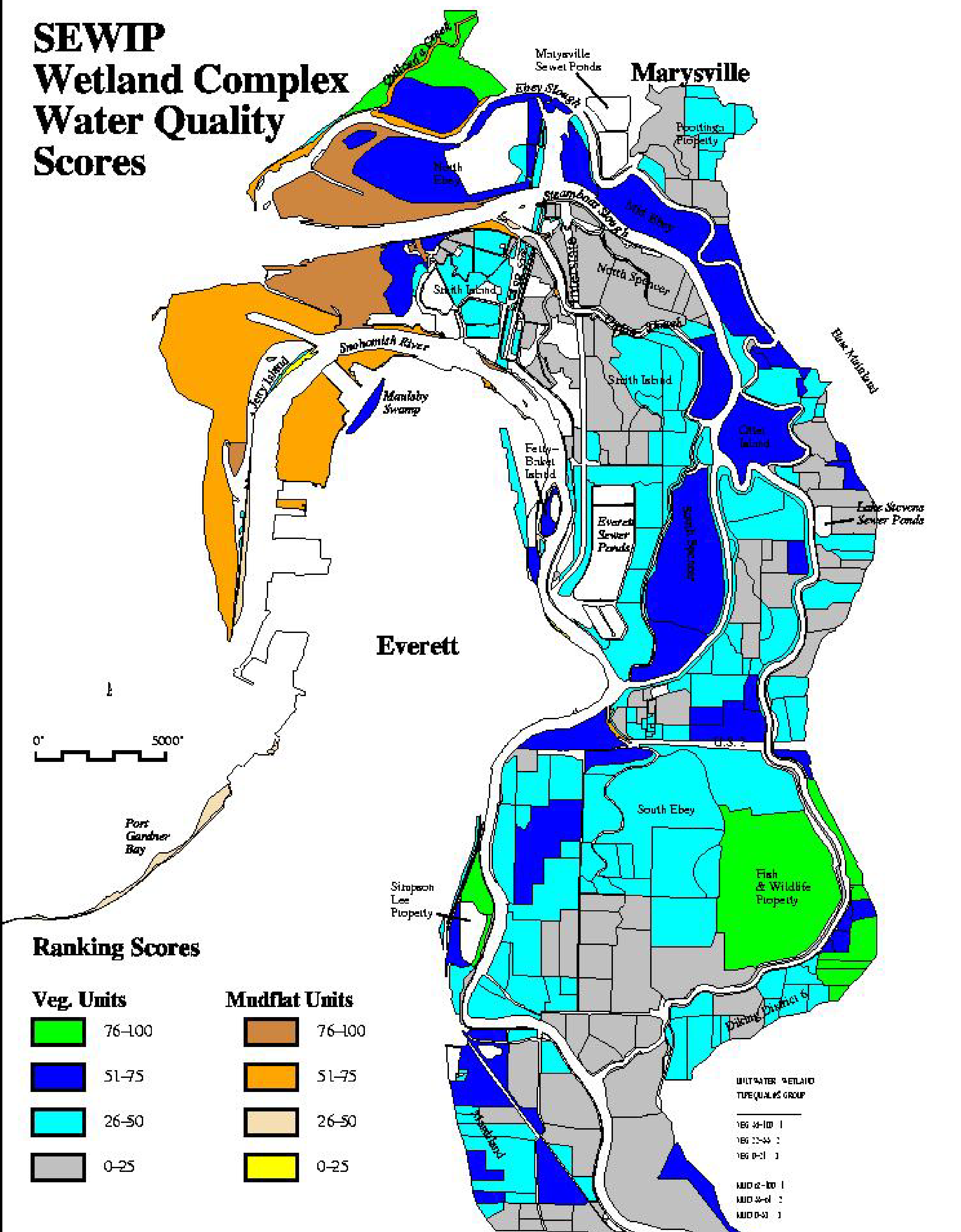

SEWIP
Wetland Complex
Water Quality
Scores
Marysville
Marysville Sewer Ponds
Ebey Slough
North Ebey
Steamboat Slough
Mid Ebey
North Spencer
Smith Island
Snohomish River
Jetty Island
Maulsby Swamp
Ferry-Baker Island
Otter Island
Lake Stevens Sewer Ponds
Everett Sewer Ponds
South Spencer
Everett
U.S. 2
South Ebey
Fish & Wildlife Property
Simpson Lee Property
Port Gardner Bay
0'
5000'
Ranking Scores
Veg. Units
76–100
51–75
26–50
0–25
Mudflat Units
76–100
51–75
26–50
0–25

Figure 4.2

In general, the heavily farmed wetlands in the southern portion of the Estuary, in the southern portion of South Ebey and Marshland, had the lowest ranking for the Water Quality Improvement Attribute. Similar pockets of lower-ranked wetland complexes could be located on the north end of South Ebey Island, the middle portion of the East Mainland, North Spencer Island, East Smith Island and portions of the Poortinga property.

4.3 Overall Wetland Groups for Wildlife and Water Quality Improvement Attributes

Figure 4.3 depicts wetland complexes classified as either Group 1, 2 or 3 relative to performance of both the Wildlife and Water Quality Improvement Attributes. A total of 11,518 acres of non-vegetated and vegetated wetland were classified. A breakdown of the wetland categorization by acreage is also presented in Figure 4.3. Vegetated wetland complexes with ranking scores greater than 35 and 44 for Wildlife and Water Quality Improvement Attributes, respectively, were placed in Group 1; those with scores from 12 to 35 and 22 to 44, respectively, were placed in Group 2; and those with scores less than 12 and 22, respectively, were placed in Group 3.

Approximately 48% (5561.5 acres) of the Estuary's wetland complexes for both vegetated and non-vegetated wetlands were classified within Group 1 for the combined Water Quality Improvement and Wildlife Attributes. Group 1 includes wetlands in the following areas: the entrance mudflats west of Smith, Ebey, Spencer and Jetty Islands; the Quilceda Creek and West Smith Island salt marshes; the tidal marshes on North and Mid Ebey Island; Otter Island; Mid-Spencer and South Spencer Island and east of Ebey Slough south of the Poortinga property and south of Highway 2; the fresh water marshes on the northern half of South Ebey immediately north and south of Highway 2; the fresh water marshes on the northern and central portions of the Simpson Lee property, portions of the Marshland area, the northern half of Drainage District 6, and Swan Slough.

Overall, these Group 1 wetlands represent an almost continuous band of wetland habitat stretching from the northern to southern boundaries of the Estuary study area which is performing wetlands functions at a relatively high level.

Edge units along the north portion of South Ebey appear to play an important role in connecting Group 1 wetland complexes to the north with similar areas south of Highway 2 on South Ebey Island.

Group 2 Wetland Complexes (2986.7 acres) comprise over 26% of Estuary study area and are primarily in the central portion of the Estuary adjacent to Group 1 wetlands.

Group 3 Wetland Complexes represent only 26% (2969.9 acres) of the Estuary study area and are entirely limited to heavily cultivated, grazed or mowed agricultural areas.

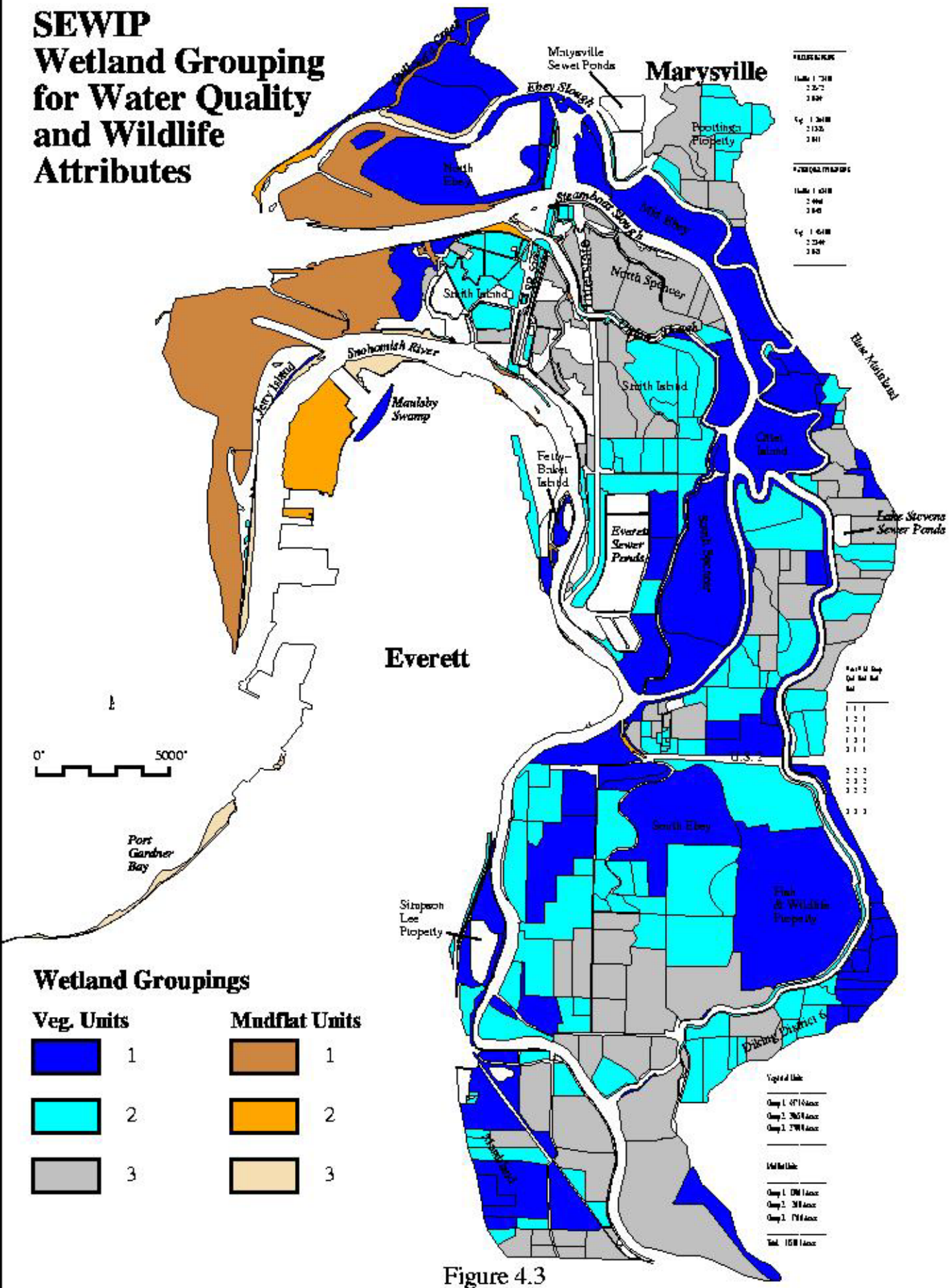

SEWIP
Wetland Grouping
for Water Quality
and Wildlife
Attributes
Marysville
Everett
Ebey Slough
Steamboat Slough
North Spencer
Snohomish River
Jetty Island
Manilaby Swamp
Smith Island
Ferry-Baker Island
Everett Sewer Ponds
Lake Stevens Sewer Ponds
Port Gardner Bay
Simpson Lee Property
Pilchuck River
U.S. 2
0'
5000'
Wetland Groupings
Veg. Units
1
2
3
Mudflat Units
1
2
3

Figure 4.3

When considering both the Group 1 and 2 wetland complexes together, approximately 71% of the vegetated wetlands and 89% of the mudflats are performing wetland functions "at a relatively moderate to high level."

The presence of a significant area of Group 1 wetland complexes throughout the Estuary and concentration of Group 2 wetland complexes adjacent to Group 1 wetland complexes indicate that the Estuary is functioning at a relatively high level of performance for the functions assessed and is still an intact estuary ecosystem that has high potential for enhancement and restoration. Group 3 wetlands have a high potential for restoration because the existing agricultural practices have not permanently degraded the former estuarine habitat and prevented the return of these lands to full tidal influence.

Chapter 5 identifies the restoration and enhancement sites, the specific measures to restore and enhance those sites, the development footprint for the Estuary, and the projected compensation ratios.

4.4 Social Significance Attribute

Figures 4.4 through 4.7 present the rankings and the Group 1, 2 and 3 classifications of Estuary wetland complexes for the Social Significance Attribute functions including the Recreation, Aesthetics and Transportation Access/Shoreline Stabilization functions. The results of the IVA questions for the Social Significance model were first presented in the January 18, 1995 draft SEWIP document. The User Group felt that the questions should be modified to better reflect conditions in the Estuary. The results presented here reflect the revised questions developed in conjunction with the User Group. Based on the frequency distribution of each data set, the rankings were broken into groups. The ranking breakdown is shown on each figure in parenthesis adjacent to the Wetland Group.

4.4.1 Recreation

For the Recreation function, the Group 1 wetland complexes generally coincided with the areas of Group 1 for Wildlife and Water Quality Improvement Attributes. For South Ebey Island the Group 1 recreation scores included most of the north end of the Island and south of Highway 2; these wetlands were concentrated on the east and west sides. All of these areas were adjacent to or within high value wetland habitat and have potential or existing public access from sloughs, waterways or public roads.

Group 3 wetland complexes for the recreation function were concentrated in the existing industrialized portion of the north portion of Smith Island by SR 529 and I-5 and along the Snohomish River on the east side of the city.

4.4.2 Aesthetics

As shown in Figure 4.5, the area for wetland complexes within Group 1 for aesthetic function was very similar to the Group 1 areas for the recreation function, except that they expand to cover most of the portion of South Ebey south of Highway 2. This generally coincides with high-value wetland habitat.

Group 3 areas for aesthetics generally coincided with the most developed and/or disturbed portions of the Estuary such as mid-Smith Island and the Everett shoreline. The Group 3 wetlands expand east of I-5 for North Spencer and Smith Islands and along both sides of Highway 2. The heavily cultivated farmland in Marshland and on the east mainland south of South Ebey Island fell primarily within Group 3.

4.4.3 Transportation Access and Shoreline Stability

As depicted by Figure 4.6, the areas classified as Group 1 for Transportation Access and Shoreline Stability were almost entirely limited to the shoreline adjacent to the Snohomish River, Port Gardner Bay and the industrialized area between SR 529 and I-5. This classification correlated primarily with the presence of a dredged channel, a stabilized shoreline and two major transportation corridors within .25 miles of a wetland complex.

The majority of the Estuary outside these areas was classified as either Group 2 or 3 and generally coincided with tidal wetlands and agricultural lands. Exceptions to this included the east side of South Ebey Island, the north edge of Marshland, and a single complex immediately north of Highway 2 on the east mainland. These complexes scored higher either because of the presence of two major transportation corridors within .25 miles or suitable infrastructure (utilities).

The User Group chose to apply a 0.5 "value" multiplier to all wetland complexes in rural areas for the Transportation Access function. With application of this multiplier, the majority of wetlands in rural areas fall into Category 3. Only four wetland complexes fall within Category 2. The User Group elected to apply the 0.5 multiplier to rural wetland complexes because industrial use was viewed as incompatible with the continuation of agriculture and protection of wetland habitat in rural portions of the Estuary.

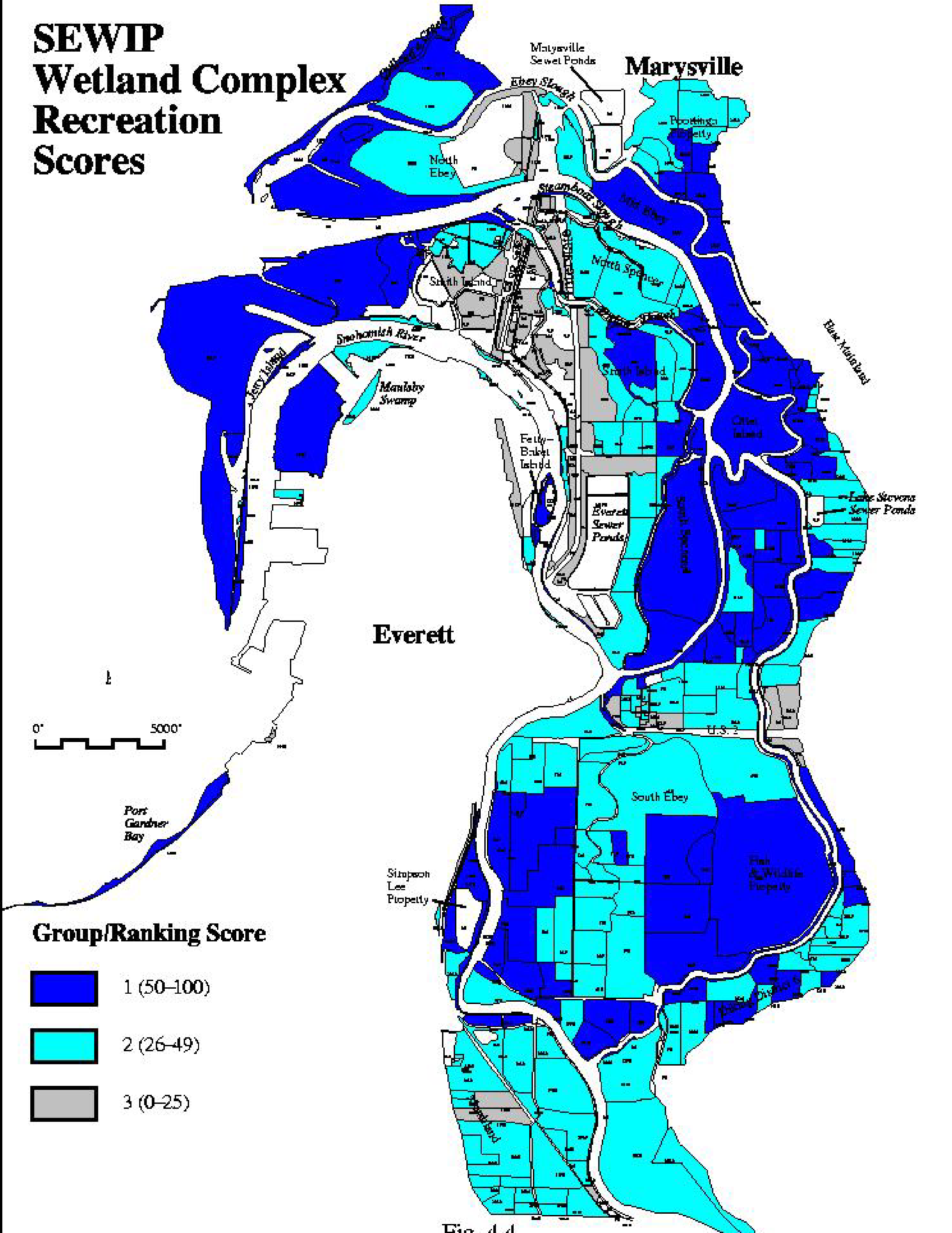

SEWIP
Wetland Complex
Recreation
Scores
Marysville
Marysville Sewer Ponds
Ebey Slough
North Ebey
Steamboat Slough
Smith Island
North Spencer
Snohomish River
Jetty Island
Maulsby Swamp
Otter Island
Ferry-Baker Island
Everett Sewer Ponds
Lake Stevens Sewer Ponds
Everett
0' 5000'
U.S. 2
South Ebey
Fish & Wildlife Property
Simpson Lee Property
Port Gardner Bay
Group/Ranking Score
1 (50–100)
2 (26–49)
3 (0–25)

Fig. 4.4

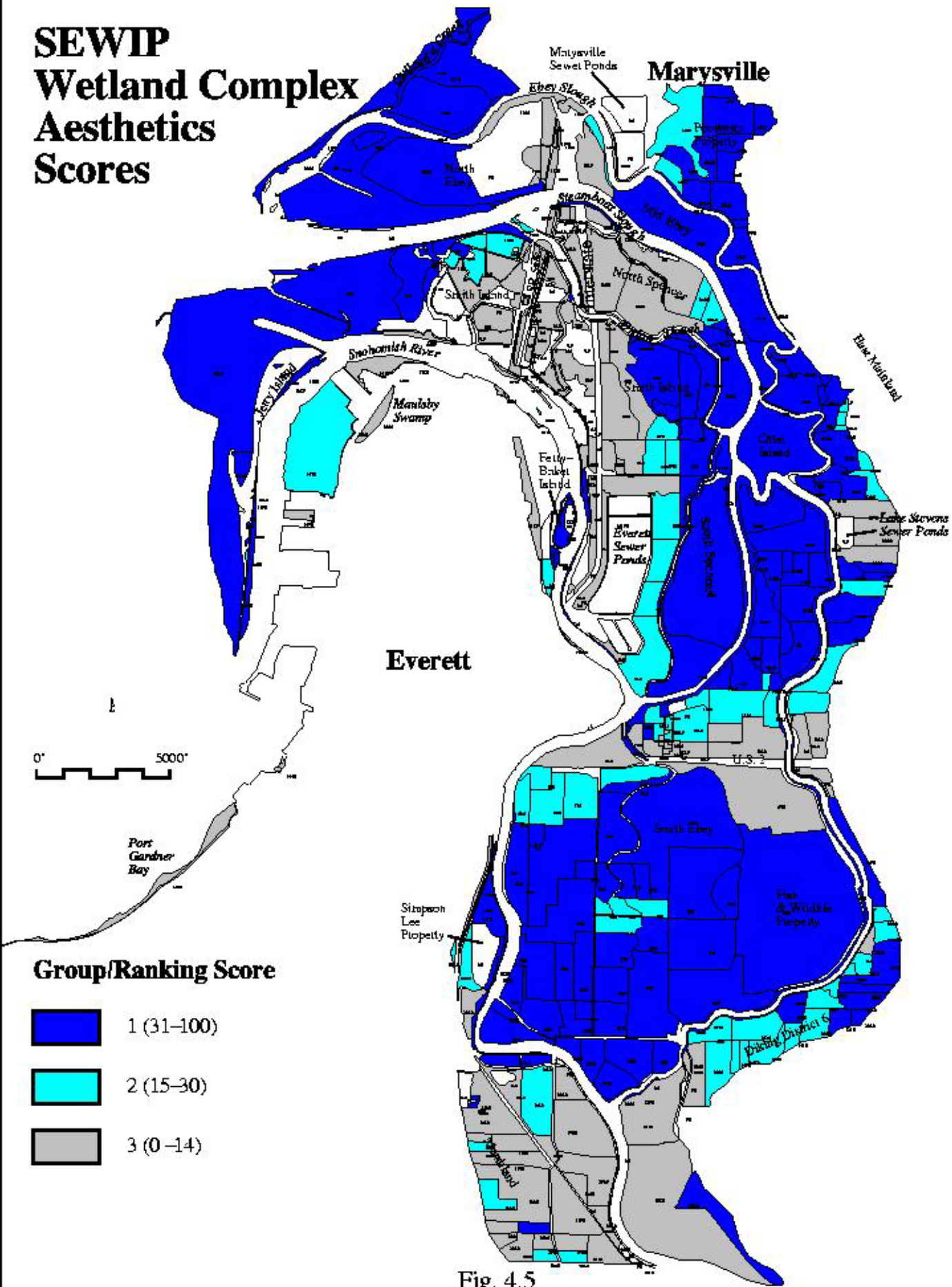

SEWIP
Wetland Complex
Aesthetics
Scores
Marysville
Everett
Ebey Slough
Steamboat Slough
Snohomish River
Smith Island
North Spencer
Jetty Island
Maulsby Swamp
Ferry-Baker Island
Everett Sewer Ponds
Port Gardner Bay
Simpson Lee Property
0'
5000'
Group/Ranking Score
1 (31–100)
2 (15–30)
3 (0 –14)

Fig. 4.5

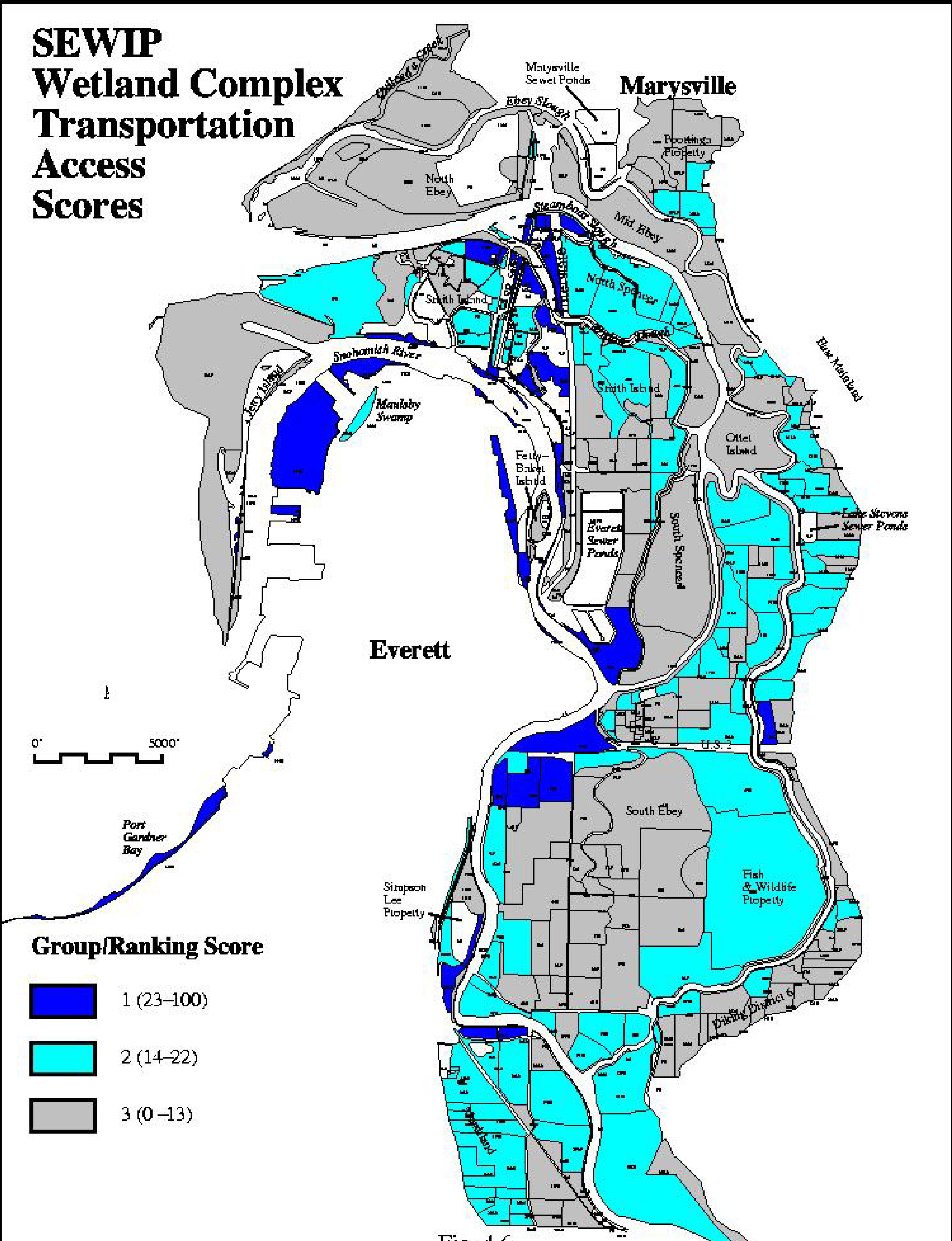

SEWIP
Wetland Complex
Transportation
Access
Scores
Marysville
Marysville Sewer Ponds
Ebey Slough
North Ebey
Steamboat Slough
Mid Ebey
North Spencer
Smith Island
Snohomish River
Jetty Island
Maulsby Swamp
Otter Island
Ferry-Baker Island
Everett Sewer Ponds
South Spencer
Lake Stevens Sewer Ponds
Everett
U.S. 2
0'
5000'
Port Gardner Bay
South Ebey
Fish & Wildlife Property
Simpson Lee Property
Group/Ranking Score
1 (23–100)
2 (14–22)
3 (0 –13)

Fig. 4.6

SEWIP Wetland Complex Transportation Access Scores

With Value Overlay

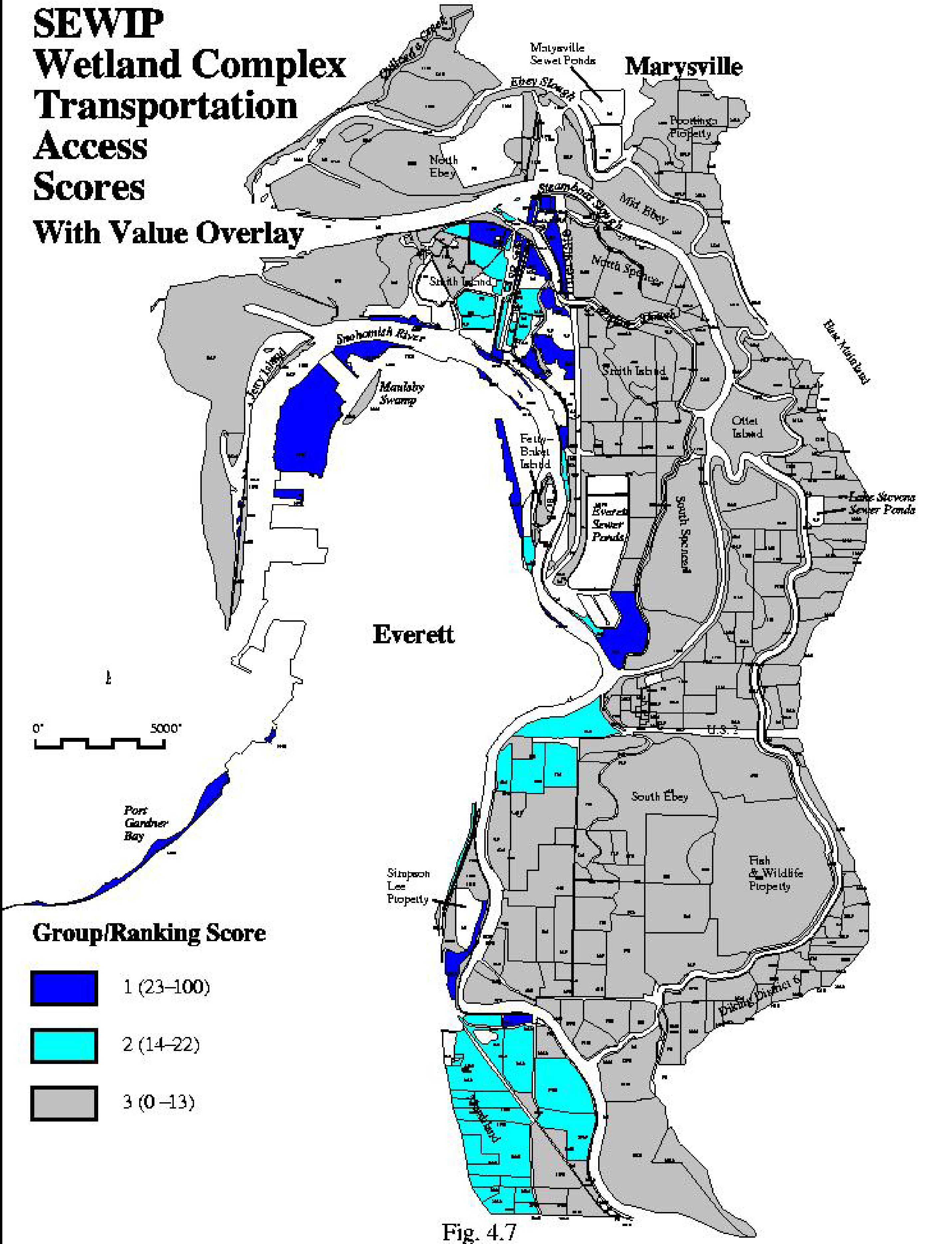


Fig. 4.7

Chapter 5 - Management Plan for Snohomish Estuary

This chapter sets forth the comprehensive Management Plan for the Snohomish Estuary. It identifies the:

- overall management goals;
- restoration and enhancement goals;
- location, type and ranking of proposed restoration for the Snohomish Estuary;
- specific restoration/enhancement "actions" for each restoration site (Table 5.3);
- development footprint; and
- compensation ratios.

The Management Plan is based on the habitat assessment results, field work to characterize the Ecological Management Unit boundaries and input from both SETAC and User Group Committees. This chapter also details the process for selecting the restoration and enhancement sites and the restoration and enhancement actions. Appendix M presents recommendations for implementing SEWIP, including non-regulatory guidance.

5.1 Overall Management Goals for the Estuary

The SETAC adopted the following main goals for the Snohomish Estuary:

Management Goal 1) No net loss of functions and values in the Estuary;

Management Goal 2) Enhancement and restoration of the Snohomish Estuary to the maximum extent feasible;

Management Goal 3) A balance between wetland ecosystem protection, enhancement, restoration and economic development within the Estuary and shoreline areas;

Management Goal 4) An efficient permit review process which promotes consistency among applicable Federal and State laws and regulations, including the Federal Section 404 review process, and provides development and environmental interests with a high degree of certainty as to the level of development permitted and the location, type, amount and cost of required mitigation; and

Management Goal 5) Detailed information provided for resource management and protection including accurate mapping of all wetland complexes, assessment of functions, and review and summary of all available biological, physical and chemical data for the Estuary.

An additional goal has arisen out of work with the User Committee:

Management Goal 6) Protection of existing undeveloped habitat areas within the Estuary.

"Restoration" shall be defined as "return of an ecosystem to a close approximation of its previously existing condition." This may include the breaking of dikes within the Estuary to convert existing palustrine wetland and non-wetland to estuarine wetland within the study area. Wetland restoration that is within the identified SEWIP restoration sites (Table 5.3) and consistent with the restoration goals and actions shall be considered under the COE regional permit for SEWIP.

"Enhancement" shall be defined as "the alteration or active management of a wetland for improvement of a particular function or functions." This may include increasing flooding of diked palustrine wetlands, planting scrub-shrub species in grazed wetlands, or removal of log rafts from tidal mudflats. Wetland enhancement for the purpose of compensating for development impacts will only be permitted under a COE individual permit.

5.2 Restoration and Enhancement Goals

Once the draft SEWIP document was completed (April 14, 1995), the SETAC established the following restoration/enhancement goals for the Estuary:

Goal 1) Tidal restoration;
Goal 2) Mudflat restoration;
Goal 3) Mudflat enhancement; and
Goal 4) Waterbird and freshwater marsh habitat enhancement.

5.2.1 Basis for Tidal Wetland and Mudflat Restoration Goal. The primary impact to approximately 12,000 acres of wetlands and mudflats within the Snohomish Estuary has been due to diking and draining for conversion to agricultural production. This has resulted in an estimated 74.4 percent (Pentec, 1992) to 85 percent (Shapiro and Associates, 1979) loss of the original estuarine and freshwater tidal wetland area. Estuarine wetlands are an extremely important component in the marine and terrestrial food chains, providing critical habitat for fish, birds, and other wildlife including species which are commercially important. Studies in the Northwest have demonstrated that estuarine marshes are more productive than any other plant communities. Frenkel measured the productivity in terms of plant biomass of a diked pasture at 1200 grams/meter^2 relative to 2300 grams/meter^2 for the same pasture ten years after it was restored to estuarine wetland (Frenkel, 1990).

Given the ecological significance of estuarine wetlands, it is appropriate that this Management Plan strive to restore diked palustrine wetlands to tidal influence. There is limited data, however, to support the assumption that the performance of functions of restored wetlands will be similar to those of natural "undisturbed" wetlands (Zedler and Weller, 1990). In fact, most wetland creations and restorations have been experimental, with the majority not meeting the "goals and criteria" set forth to measure success.

Kusler and Kentula (1990), however, have concluded that the probability of restoration success is greatest for estuarine marshes, followed by marshes of the open coast, freshwater marshes, and least for forested wetlands.

The greater restoration success experienced with estuarine marshes is due to: 1) the assurance of hydrology and the ability to accurately predict and design proper hydrology; 2) a relatively small number of plant species to work with; 3) the availability of seeds and plant stocks; 4) relative ease of establishing these species; and 5) extensive literature on estuarine restoration and experience from numerous estuarine restoration projects.

In the Estuary several previously diked and farmed areas have been returned to tidal influence through lack of maintenance of the dikes. These areas include Mid-Ebey Island (WC 141 and 144) and Mid Spencer Island (WC 138). The dikes on Mid-Ebey Island are believed to have broken in the 1930's or 1940's, and the dike on Mid-Spencer broke in approximately 1966. Both these areas scored as Group I wetlands, indicating a high level of performance for all functions. These restored wetlands have developed dendritic channels and a diverse cover of emergent and scrub-shrub vegetation. Therefore, even without a restoration and monitoring plan, these sites have successfully returned to a "functioning" estuarine marsh ecosystem.

Shreffler and Thom (1993) state that "the chances of successful restoration are higher if the landscape is relatively intact even though the degree of disturbance of the restoration site is high." The proposed restoration wetlands within Ecological Management Units 1 and 2 have been degraded by agriculture, but the large continuous core of adjacent wetlands (Mid-Ebey Island, Otter Island, Mid-Spencer, and South Spencer Island are relatively undisturbed and are ranked as Group 1 wetlands (i.e. high performance of wetland functions). From a landscape perspective, the pattern of wetland rankings suggests that Ecological Management Units 1 and 2 have a high potential for restoration.

Based on previous field work conducted by SETAC members, it was their conclusion that restoration of diked wetlands will provide fish habitat for the full range of Estuary fish species in addition to much needed overwintering and freshwater/saltwater transition habitat for juvenile salmonids. Additionally, the committee members stated there is a great need in the Estuary to provide for continuous migration corridors for juvenile salmonids and other species. Presently, there are long stretches of shoreline in the Estuary that are degraded by rip-rap and cleared constructed dikes. Restoration of this degraded edge habitat to tidal habitat along slough and river edges will reduce predation of juvenile salmonids, increase feeding opportunities for juvenile salmonids, and decrease water temperature while increasing its dissolved oxygen content. All of these factors together will act to decrease the mortality rate of outmigrating salmon.

5.2.2 Basis for Non-tidal Marsh Enhancement Goal. The management objectives for Ecological Management Unit 1 are to protect agriculture and existing forested and scrub-shrub habitat and to enhance agricultural lands to provide habitat for wildlife such as waterfowl and other wetland-dependent species.

On a regional basis the Snohomish Estuary is an important habitat for overwintering and migrating waterfowl and other waterbirds. It provides an alternative refuge site for waterbirds during the winter to escape severe weather present at estuaries in Northern Puget Sound and the Fraser Estuary in Canada. For example, ducks move 15 to 110 km south from the Fraser River Delta to numerous bays and estuaries in Puget Sound to find food sources (Shreffler & Thom, 1993).

Agricultural fields are very important to a large number of waterbirds. Brennan reports that shorebirds and waterfowl feeding intertidally typically roost in adjacent fields at high tide or during storms (Brennan et al., 1985). Shreffler and Thom (1993) state that large intertidal areas without adjacent farmland usually support fewer ducks and do not provide complete wintering habitat. This is due to the fact that *Zostera japonica* is not available in the winter, and surface feeding ducks switch to feeding in freshwater wetlands. Therefore, in Table 5-4 this Plan identifies the enhancement of specific agricultural fields through a combination of flooding and planting of off-season crops in currently plowed fields for forage and encourages grazing or mowing to reduce the height of reed canary grass.

5.3 Identification of Restoration Enhancement Sites

To identify suitable restoration sites meeting each of the overall restoration and enhancement goals or objectives, the following steps were undertaken by SETAC:

1. Identify the appropriate restoration and enhancement goal (objective) and restoration potential for each restoration site in Estuary (Figures 5.1 and 5.2A and B).
2. Rank the potential restoration and enhancement sites (Figure 5.3).
3. Map the final restoration sites (Figure 5.4).
4. Identify the specific restoration actions for each restoration site. This constituted the restoration plans.

For step 1, criteria critical to successful wetland restoration for each restoration goal were identified by SETAC. These criteria included elevation, substrate type, hydrology and landscape location. The criteria were included in a survey questionnaire which was then applied to each of the 367 wetland complexes in the study area. The wetlands with the highest potential for restoration (i.e. meeting the highest number of restoration and enhancement criteria for each goal) were mapped and are depicted in Figure 5.2A and B. Based on Figures 5.2A and B, the predominant restoration goal criteria for a particular site became the selected restoration goal. If a dominant goal for a site could not be determined, then all goals were ranked in the next step.

In step 2, SETAC ranked each of the restoration and enhancement sites and the goals identified in Figure 5.2. The ranking was based on feasibility and social criteria, including: technical feasibility of implementing restoration/enhancement actions; willingness of owner to sell land for restoration/enhancement; and value of type of restoration habitat to society. SETAC found that of the top seven ranked sites, six were for tidal restoration sites. These sites included: the Poortinga property; North Spencer (Biringer Farm); agricultural lands south of Nyman Farm on the East Mainland (Sunnyside); north end of South Ebey (0.7 miles north of Highway 2); and East Smith Island.

Figure 5.1 - Snohomish Estuary Restoration Goals Criteria Questionnaire		
1) Natural[1] Tidal Habitat Restoration Objective (Apply to diked wetlands only)		
Includes restoration of fish, bird, invertebrate functions (This objective would result in the complete or partial removal of dikes).		
1A) Vegetated Tidal Marsh		
Criterion 1 - Site <u>does not</u> contain diked area of group 1 wetlands for the bird, mammal and/or herptile functions.		
Criterion 2 - Circulation. Remnant tidal channels and streams present which will facilitate tidal circulation (drainage ditches do not qualify).		
Criterion 3 - Water Access. A site meets this criterion if it is immediately adjacent to a tidal waterway (separated by a dike) or is within 200 feet of a tidal waterway and would be flooded if the <u>dike on the tidal waterway</u> was broken.		
Criterion 4 - Elevation. More than 50% of the site falls within the elevation range of +7' MLLW to +12' MLLW. (Optimal elevation for emergent plant growth is +9.7' to +11.1' MLLW in the Snohomish Estuary).		
Criterion 5 - Presence of Herbicides. The site has <u>not been</u> cultivated and cropped in the last year (herbicides remain latent in soils and impede growth of wetland vegetation in restoration sites)		
Criterion 6 - Substrate. Site does not contain dredge spoils, fill material (including concrete, asphalt, refuse and upland soils), wood waste or presence of toxic substances in soils.		
1B) Intertidal Mudflat Habitat		
Criterion 1 - Site <u>does not</u> contain diked area of group 1 vegetated wetlands for the bird, mammal and/or herptile functions.		
Criterion 2 - Circulation. Remnant tidal channels and streams present which will facilitate tidal circulation (small drainage ditches which do not contain streams do not qualify).		
Criterion 3 - Water Access. A site meets this criterion if it is immediately adjacent to a tidal waterway (separated by a dike) or is within 200 feet of a tidal waterway and would be flooded if the <u>dike on the tidal waterway</u> was broken.		
Criterion 4 - Elevation. More than 50% of the site falls within the elevation range of -3' MLLW to +7' MLLW. .		
Criterion 5 - Presence of Herbicides. The site has <u>not been</u> cultivated and cropped in the last year (herbicides remain latent in soils and impede growth of wetland vegetation in restoration sites)		
Criterion 6 - Substrate. Site does not contain dredge spoils, fill material (including concrete, asphalt, refuse and upland soils), wood waste or presence of toxic substances in soils.		
2) Mudflat Enhancement Objective (Apply to tidal sites only)		
Includes restoration of fish, bird, invert and mammal functions		
Criterion 1 - The site is an existing mud or sandflat that is degraded by log rafting and/or bulkheads (e.g. pile sheeting and pilings)		
3) Wildlife Habitat Enhancement Objective (On Existing Agricultural Land)		
Includes Restoration of Overwintering, Migrating & Breeding Bird Habitat		
Criterion 1 - Site <u>does not</u> contain area of Group 1 vegetated wetlands for the bird, fish and mammal functions.		
Criterion 2 - Normal Flooding Regime During Winter and Spring Months. The percent of seasonal open water is less than or equal to 10% of the total site and the site is currently ditched and drained (i.e. This criterion measures the potential for increasing flooding on a site which provides predator control but does not remove all food sources for overwintering birds - 25% areal coverage of open water is best according to Baldwin & Lovvorn - and this range of open water also benefits breeding and migratory birds)		
Criterion 3 - The site is part of at least a 50 acre agricultural complex (fallow or actively farmed). (Because portions of farm land can be restored to scrub-shrub and forested habitat, breeding and migrating bird objectives would also be met.)		

4) Freshwater and Managed[2] Tidal Habitat Restoration Objective (Apply to Diked Wetlands only)		
Includes restoration of the fish and migrating, overwintering & breeding bird functions (Note - the primary intent of this Restoration Objective is to allow for the continuation of agriculture by maintaining dikes).		
Criterion 1 - Diked site contains fish or upstream reaches of stream or creek has fish and flows into the subject site.		
Criterion 2 - Water Quality. Year round flowing streams are present on the diked site.		
Criterion 3 - Circulation. Remnant tidal channels and streams present within the diked site which will facilitate tidal circulation (small drainage ditches do not qualify) & comprise 25% of complex perimeter.		
Criterion 4 - Habitat Complexity. Diked site contains or is immediately adjacent to diked Group 1 wetlands for the overall Water Quality and Wildlife Habitat Attribute (Figure 4.3 - e.g. these sites typically contained scrub-scrub or forested habitat which would provide needed shading, terrestrial insects and nutrient input for fish habitat).		
1 - "Natural" means that a restoration site will be open to the full range of tidal influence through breaks in an existing dike and tidal influence shall not be conveyed through culverts or other similar structures including dikes of lower elevation allowing tidal inundation at higher tides but retaining water behind these dikes at lower tides. *2 -"Managed" means that tidal influence on a restoration site will be conveyed through a culvert or other similar structure including dikes which allow tidal inundation at higher tides but retain water behind these dikes at lower tides.*		

For Step 4, SETAC mapped the top ranked restoration sites, which were all tidal restoration sites, and determined that enhancement sites should only be used on a "non-regulatory" or volunteer basis. If the enhancement sites were to be used for compensation as part of a regulatory action, they would be reviewed under the COE individual permit process.

For Step 5, SETAC visited each of the top ranked restoration and enhancement sites and developed restoration actions (plans) for them.

5.3.1 Basis for Selecting Restoration/Enhancement Sites for Evaluation. One of the principal objectives of this Management Plan is to restore and enhance the Estuary to a stable, self-sustaining ecosystem. A stable ecosystem will not:

- "collapse" when subjected to the range of possible natural environmental variations such as flooding, erosion and debris flows; or

- require constant human intervention to achieve that stability.

The structure of the restored/enhanced Estuary is critical in creating a stable, self-sustaining ecosystem. Structure consists of "patches" of habitat, their shape and location in the Estuary, and the corridors connecting these patches. Without all of these elements, restoration and enhancement efforts have little chance of success (Shreffler & Thom, 1993). In general, tidal marshes of at least 250 to 300 acres appear to be stable and functional ecosystems (Collins et al., 1987). Patches of larger size tend to support more species, unless they are widely

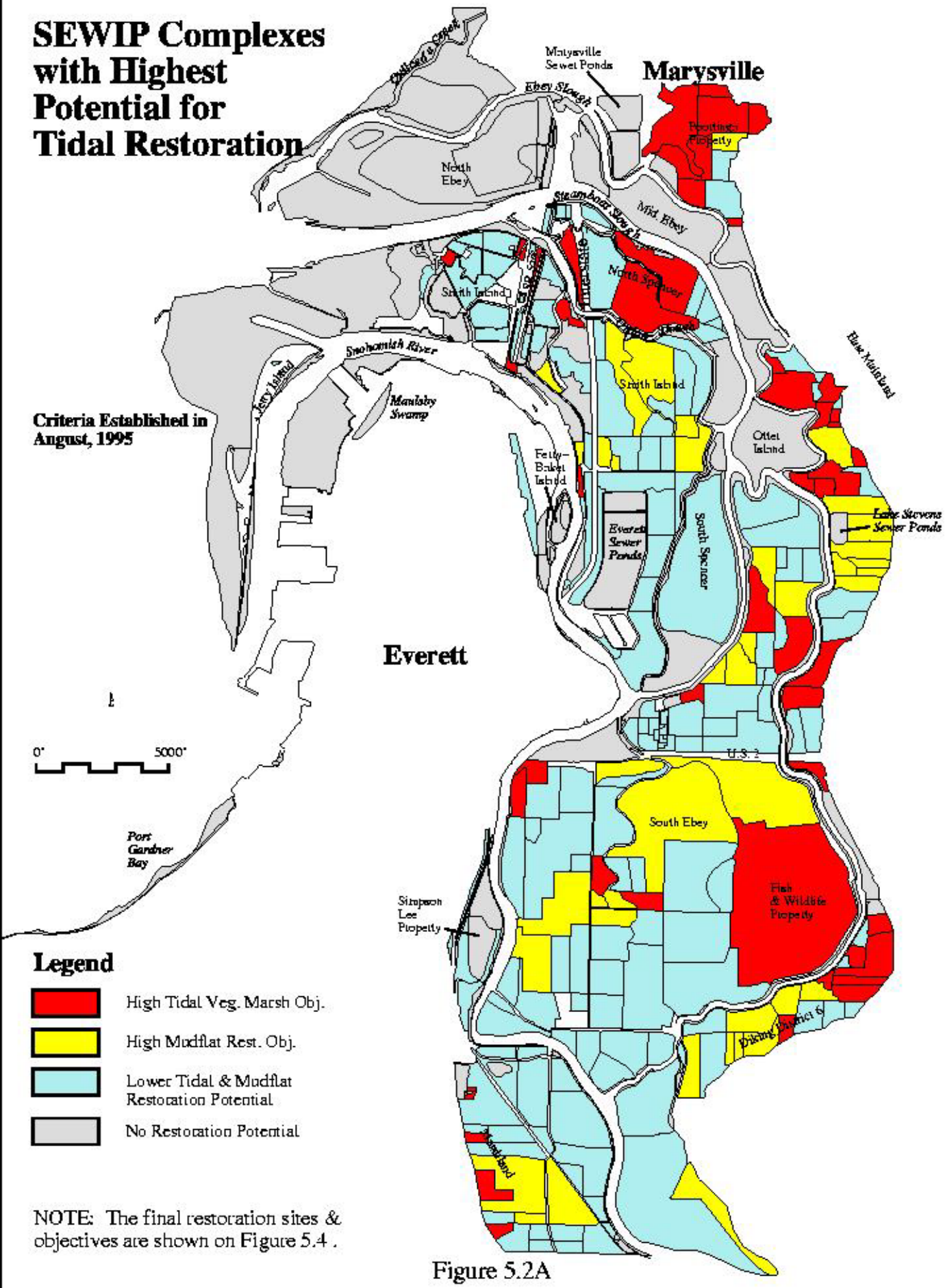
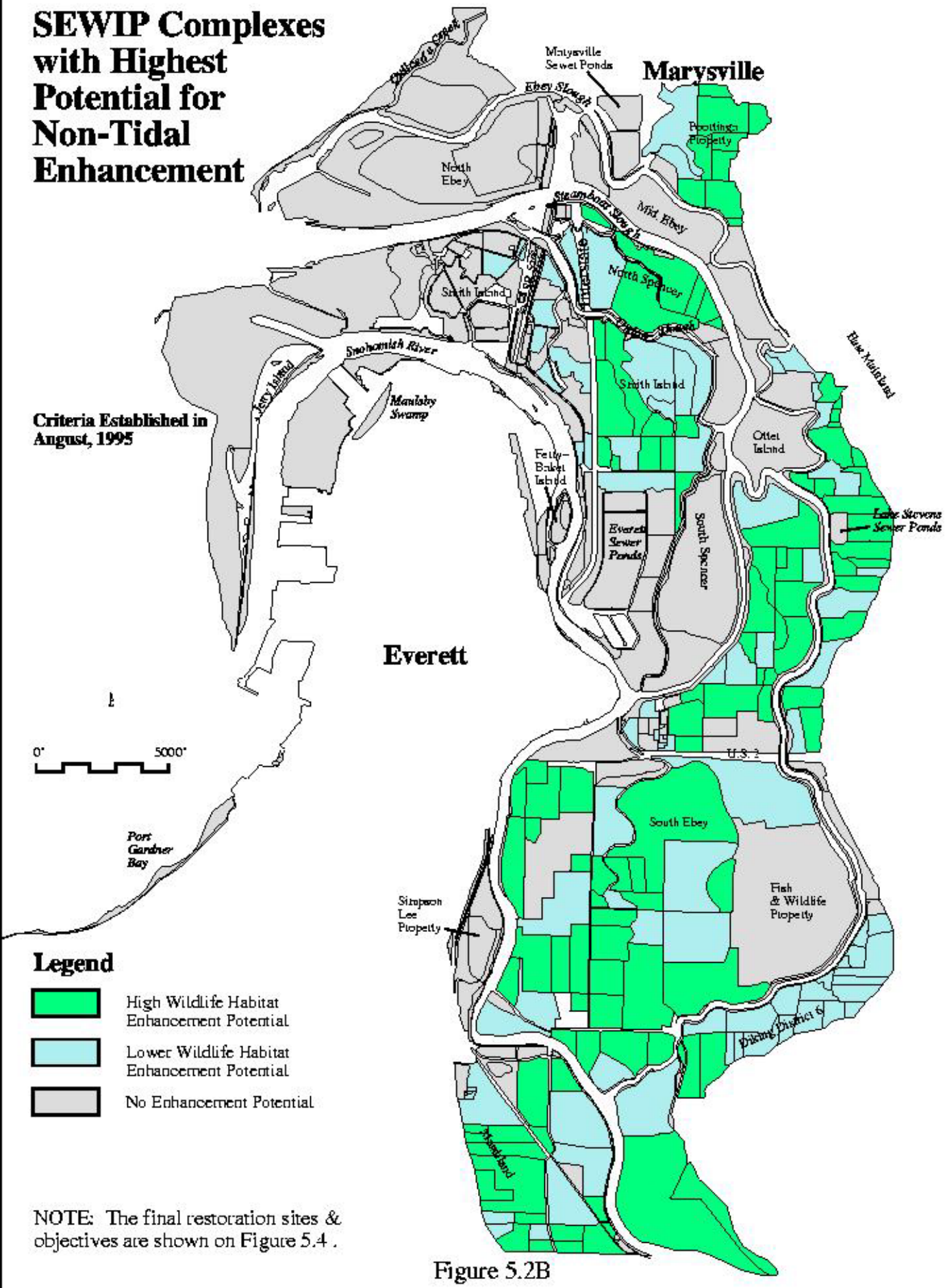

SEWIP Complexes with Highest Potential for Tidal Restoration
Criteria Established in August, 1995
Marysville
Everett
Marysville Sewer Ponds
Ebey Slough
North Ebey
Steamboat Slough
Mid Ebey
North Spencer
South Spencer
Smith Island
Snohomish River
Jetty Island
Mainlby Swamp
Ferry-Baker Island
Everett Sewer Ponds
Otter Island
Lake Stevens Sewer Ponds
U.S. 2
South Ebey
Fish & Wildlife Property
Simpson Lee Property
Port Gardner Bay
0'
5000'
Legend
High Tidal Veg. Marsh Obj.
High Mudflat Rest. Obj.
Lower Tidal & Mudflat Restoration Potential
No Restoration Potential
NOTE: The final restoration sites & objectives are shown on Figure 5.4 .

Figure 5.2A

SEWIP Complexes with Highest Potential for Non-Tidal Enhancement



NOTE: The final restoration sites & objectives are shown on Figure 5.4 .

Figure 5.2B

separated small patches whose isolation results in increased speciation through the "island effect" (Shreffler & Thom, 1993). Patches should be connected in a manner that promotes export of primary productivity, movement of fish and animals, and a high diversity of "non-opportunistic" native species. Shreffler and Thom concluded that "unconnected habitats are not preferable and that restoration of systems supporting large and small habitats, with maximum connectance. is a more appropriate restoration concept."

To implement these principles for vegetated wetlands, the restoration sites considered for evaluation are large areas of habitat that are adjacent to the "core" of Group 1 wetlands which are relatively undisturbed. These tidal restoration areas are depicted in Figure 5.4A and include the Poortinga Property on the east mainland, North Spencer Island and Drainage District 6. To increase habitat connectivity the Plan is recommending enhancement of scrub-shrub corridors along ditches at the edge of agricultural fields, particularly between the forested habitat on South Ebey and along the "water-edge" units.

5.3.2 Effect of Elevation on Restoration Goal. Elevation is a primary control on most tidal marsh processes because it determines the frequency and period of daily and seasonal tidal inundation (Frenkel 1990). Therefore, elevation was one of the primary criteria in evaluating the appropriate type of restoration for the selected restoration sites.

Based on City of Everett and Snohomish County review of 1973 Corps of Engineers elevation maps and soil surveys, it was determined that considerable subsidence appears to have occurred in the Estuary as the result of diking, draining and farming activities. The 1973 COE elevation maps were based on air photo interpretation. Subsidence has been well documented in the San Francisco Bay area delta farmlands due to degradation (oxidation and collapse) of the peat soils and compaction of the clay-peat soils by farming activities (Josselyn et al, 1989). The Snohomish silt loams within the Estuary are underlain by peat and would be subject to the same process of oxidation and compaction once they were drained and farmed.

Estuary subsidence can be observed in the area that incorporates Otter Island and the East Mainland farmlands, directly to the southeast across Ebey Slough by the Lake Stevens Sewer Plant (WC 213 & 229). The same soil type, Puget Silt Clay Loam, underlies this entire area and should have been within the same elevation range prior to diking in the 1800's. Because Otter Island has never been diked, it is assumed that its present elevation reflects the historical elevation for adjacent areas with the same soil type. The elevation of the East Mainland wetland complexes within the same soil unit, however. is approximately five to six feet lower (+7 to +8 ft MLLW) than that of Otter Island (+13 ft MLLW). Much of the farmed diked wetland complexes within the Estuary have a ground surface elevation of +7 to +8 ft MLLW.

Predicting vegetation types based on elevation is difficult because a variety of interacting factors (salinity, elevation, velocity of tidal waters, length of inundation) constantly change in relationship to each other as one moves from the mouth of the Estuary to areas upstream. General predictions can be made based on previous research and on SEWIP vegetation inventories and elevation data, as provided in Table 5.1.

Figure 5.3 Technical & Social Ranking Criteria for Restoration/Enhancement Sites

Technical Feasibility Criteria (Includes Consideration of Cost of Implementing Project)

Technical measures for project sites were ranked high if they were found to present no major technical obstacles to the implementation of proposed general restoration/enhancement objectives established from Figure 5.1 and depicted in Figure 5.2 for the site. For example, a site recommended for tidal restoration would rank high under the "technical feasibility criterion" if it was easy to flood and offered existing natural and human-made features that would reduce the need for extensive cross-diking, and did not present major technical obstacles such as the need to relocate major public utilities (large water and electrical lines and facilities). If the technical costs were judged to be excessive, the project was ranked low.

Very High	5	No technical difficulties
High	4	Minor technical difficulties
Medium High	3	Moderate to minor technical difficulties
Medium	2	Moderate technical difficulties
Low	1	Significant technical difficulties

Land Status Criteria

Very High	5	Land(s) privately owned -- owner(s) has expressed willingness to sell all of property being considered for restoration/enhancement.
High	4	Land(s) privately owned. Some land owners have indicated willingness to sell.
Medium High	3	Portion in public ownership. Other owners either willing to sell or status unknown.
Medium	2	Significant portion of the land publicly owned or voluntary "non-regulatory restoration/enhancement" measure proposed.
Low	1	Owner(s) unwilling to sell or status unknown.

Position in Landscape Criteria

Very High	5	Restoration/enhancement will be a "saltmarsh or mudflat".
High	4	Restoration/enhancement will be a "brackish" tidal marsh.
Medium High	3	Restoration/enhancement will be a fresh water tidal marsh.
Medium	2	Restoration/enhancement will be a fresh water diked marsh.
Low	1	Restoration/enhancement will be creation of habitat corridors or enhancing flooding regime of agricultural wetlands, or planting edges of field with wetland and buffer species.

Wetland researchers have found that most intertidal vascular emergent species occur primarily between Mean Lower High Water (+9.39 ft. in Snohomish Estuary) and Mean Higher High Water (11.11 ft. in Snohomish Estuary) (Lewis 1982).

Table 5.1 indicates that mudflats are generally found below +6 feet MLLW; emergent wetlands generally above +7 feet MLLW; and scrub-shrub, forested marshes above +12 feet MLLW.

In terms of plant species diversity, a restored tidal marsh at +7 feet MLLW may have only one dominant species, two dominant species at + 8 feet MLLW, and three dominant species at +9 feet MLLW. Plant species diversity generally increases above +12 MLLW where a combination of emergent, scrub-shrub and forested wetland classes were found. It should be cautioned that plant diversity alone is not a good indicator of the overall performance of functions for tidal marshes. These marshes typically have low plant diversity but high performance for the primary productivity and fishery functions.

Table 5.1
Selected Species and Observed Elevations in Estuary

Elevation Above MLLW in Feet	Dominant Plant Species	Habitat Type	Wetland Complex Number
+ 5.9 MLLW	Marine Algae, Diatoms (Mudflat)	Intertidal Mudflat	19, 171 Entrance Mudflats
+ 6.9 MLLW	*Carex lyngbyei*	Emergent Intertidal Salt Marsh	133, 134, 135, 18 Quilceda, N. Ebey, W. Smith
+ 9.9 MLLW	*Carex lyngbyei*	Emergent Brackish Intertidal Marsh	144, 138 Mid Ebey and Spencer
+ 8.8 MLLW	*Scirpus acutus*	Emergent Intertidal Salt Marsh	132 Quilceda
+ 7.9 MLLW	*Scirpus acutus*	Emergent Intertidal Brackish Marsh	148 Mid Ebey
+ 8.9 MLLW	*Typha latifolia*	Emergent Intertidal Brackish Marsh	144 Mid Ebey
+ 11.9 MLLW	*Typha latifolia*	Emerg/SS/Forest Intertidal Brackish & Freshwater Marsh	105 Otter Island
+ 11.9 MLLW	*Lonicera involucrata*	Scrub-shrub Inter-tidal Brackish Marsh	141 Mid Ebey
+ 12.9	*Lonicera involucrata*	Scrub-shrub Inter-tidal Brackish Marsh	137 South Spencer

Source: SEWIP Wetland Complex Inventories and COE 1973 Flooding Map for Snohomish Estuary

Table 5.2 Restoration Site Ranking Scores and Prioritization
(Sites # 1, 2, 2A, 3, 4, 4A are full-tidal restoration, and # 5 is partial tidal)

Restoration Site Rank and WC #	Technical Criteria	Land Status Criteria	Position in Land-scape Criteria	Total Points for Three Criteria
1) Poortinga, WC 146, 147, 339-343, 360-363	3	5	4	12
2) North Spencer (Biringer Farm) WC 268, 295-301, 303-306	5	2	4	11
2A) Agricultural Lands South of Nyman. Diking District 4. WC 124, 130, 178, 210-213, 215, 217-220, 221-226, 229, 326, 327, 337, 338, 333-335, 358	4	4	3	11
3) South Ebey north of Hwy 2, Alter 2, WC 102, 103, 104, 106-108, 110-115, 348.	4	3	3	10
3A) South Ebey WC 60, 61, 63, 66, 69	5	3	2	10
4) South Ebey north of Hwy 2, Alter 1. WC 103 and 104.	4	2	3	9
4A) East Smith Island. WC 31, 32, 32.1, 34-40, 42, 42.1, 43, 98, 99, 345.	4	1	4	9
5) Nyman Farm. WC 139	3 (Engineering for culverts difficult due to partial tidal regime)	2	3.5	8.5
6) South Ebey, South of Hwy 2, WC 81	5	1(2)	2	8 (9-Non regulatory)
6A) South Ebey, WC 84	5	1(2)	2	8 (9-Non Regulatory)
6B) Drainage District 6, South of city of Everett Water Line, WC 96, 242, 243, 246-249.	5	1(2)	2	8 (9-Non Regulatory)
6C) Marshland. WC 193, 195-197, 198-205, 207, 208, 209, 262-265, 318-321, 322-325, 329, 330	5	1(2)	2	8 (9-Non Regulatory)
6D) Southwest portion of S. Ebey, WC 206	4	1(2)	3	8 (9-Non Regulatory)
6) Swan Slough WC 251-252	5	1 (2)	2	8 (9-Non Regulatory)
7) Drainage District 6 North of City of Everett Water Line. WC 230-233, 235-241, 245, 331, 332	2	2	3	7
7A) Southwest portion of S. Ebey. WC 64-65	5	1 (2)	1	7 (8-Non Regulatory)
8) Swan Slough WC 253	3	1 (2)	2.5	6.5 (7.5-Non Regulatory)
9) South Ebey WC 83, Fish & Wildlife Property - Manage Site as is	NA	NA	NA	NA

"Non-regulatory score" reflects the implementation of voluntary measures at site.

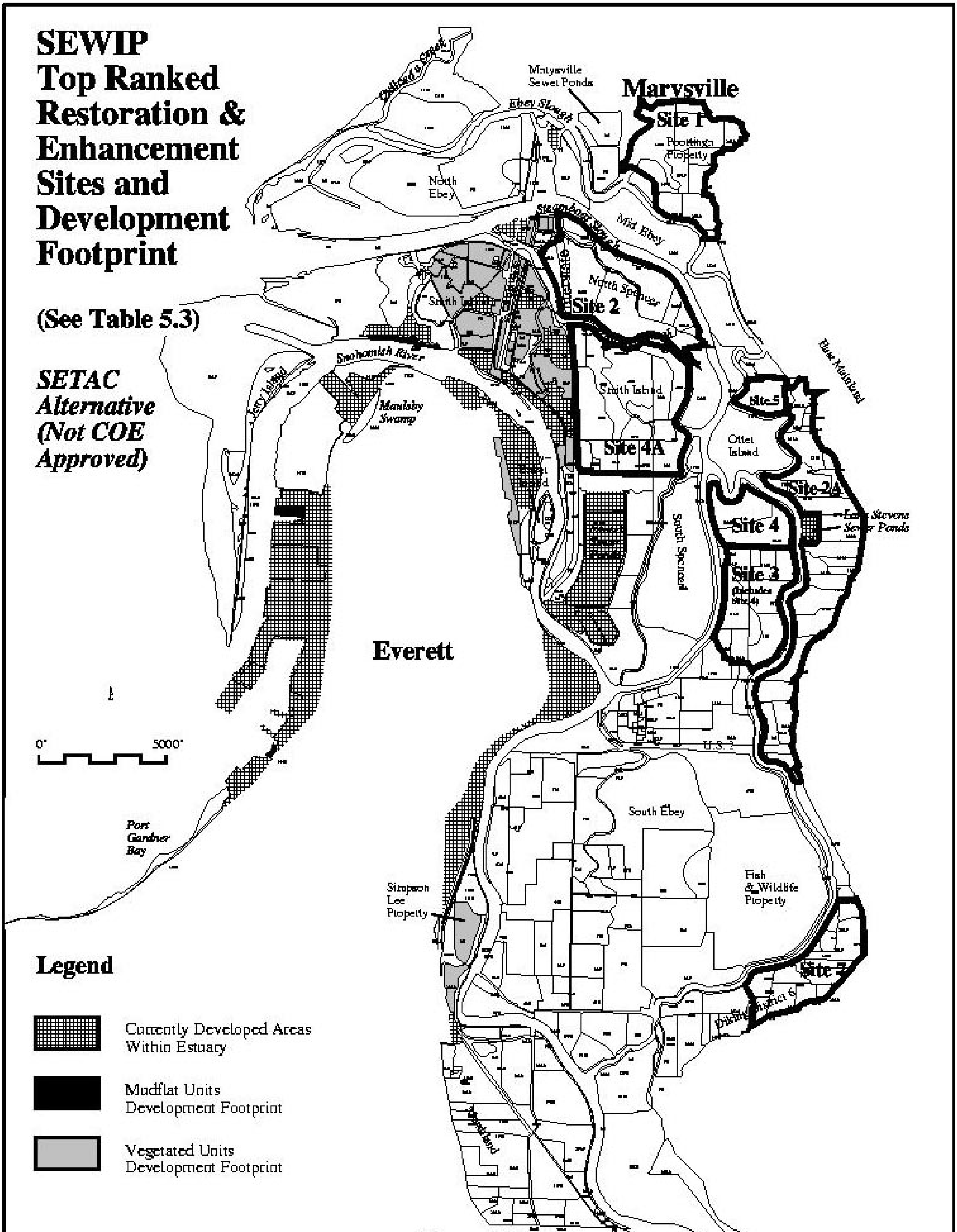
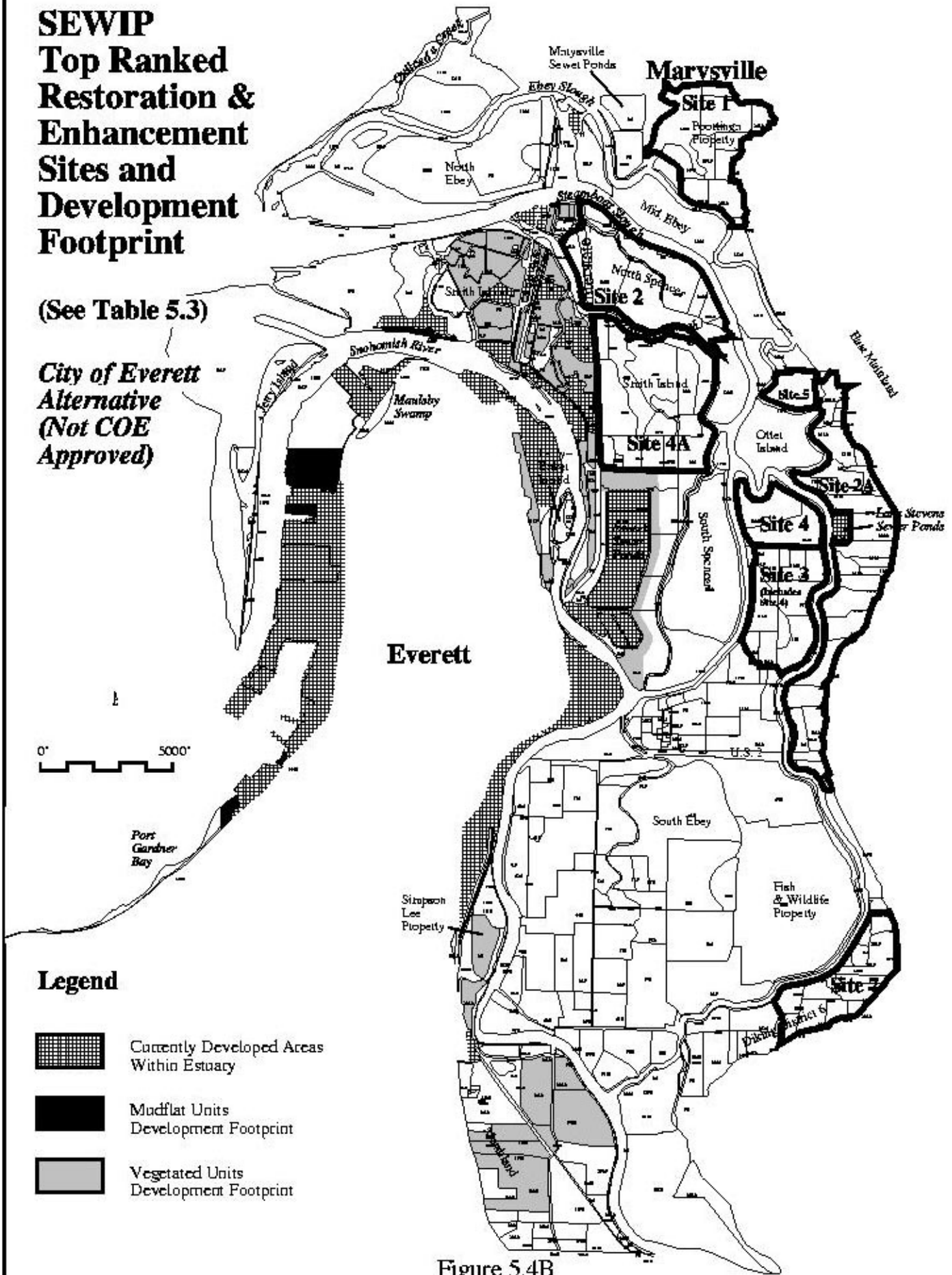

SEWIP
Top Ranked
Restoration &
Enhancement
Sites and
Development
Footprint
(See Table 5.3)
SETAC
Alternative
(Not COE
Approved)
Marysville
Marysville
Sewer Ponds
Site 1
Ebey Slough
North
Ebey
Mid Ebey
Steamboat Slough
North Spencer
Site 2
Smith Island
Snohomish River
Maulsby
Swamp
Site 5
Otter
Island
Site 4A
Site 2A
Site 4
Lake Stevens
Sewer Ponds
South Spencer
Site 3
Everett
0'
5000'
U.S. 2
South Ebey
Port
Gardner
Bay
Simpson
Lee
Property
Fish
& Wildlife
Property
Site 7
Legend
Currently Developed Areas
Within Estuary
Mudflat Units
Development Footprint
Vegetated Units
Development Footprint

Figure 5.4A

SEWIP Top Ranked Restoration & Enhancement Sites and Development Footprint

(See Table 5.3)

City of Everett Alternative (Not COE Approved)



Legend

- Currently Developed Areas Within Estuary
- Mudflat Units Development Footprint
- Vegetated Units Development Footprint

Figure 5.4B

Therefore, the lower limit for vegetated tidal marshes in the Estuary appears to approximately be +7 to +8 MLLW. For the Restoration Objectives Criteria Questionnaire, restoration sites above +7 MLLW were considered to be potential vegetated wetlands, and restoration sites below +7 MLLW were considered potential mudflat habitat.

Because a large portion of the Estuary has subsided to elevations ranging from +5.9 feet MLLW to +8.9 feet MLLW, SETAC was concerned that return to full tidal influence may result in large areas of unvegetated habitat and homogenous emergent communities without the establishment of the historical forested and scrub-shrub communities. Northwest researchers have documented that sediment accretion ranges from very slow to rapid in restored estuarine wetlands. The mean sediment accretion, for example, in a restored Salmon Creek Estuary tidal marsh was 3.6 cm (1.4 inches) with a maximum of only 7.7 cm (3 inches) over a 10-year period (Frenkel 1990). This sediment accretion measurement included the effects of soil "rebound" caused by the buoyancy effect of water on the soil column. Therefore, if a diked agricultural field at elevation +8 MLLW were restored to tidal circulation, elevations suitable for a forested, scrub-shrub swamp may not be attained for more than 160 years based on the maximum accretion rate for the Salmon Creek Estuary.

Sediment accretion for the Gog-Le-Hi-Te estuarine wetland restoration in the Puyallup River Estuary, however, was an average of 4.8 cm per year (2 inches) with a maximum accretion rate of 25 cm per year (10 inches) (Simenstad, 1995). Applying these erosion rates to the previously diked +8 MLLW agricultural field, elevations suitable for a forested, scrub-shrub swamp would be reached within 4.8 to 24 years. Given this range of accretion rates and the fact that any restoration would be a permanent long-term project, it was decided that the potential initial homogeneity of the emergent or mudflat habitat would not negatively impact the wetland functions over the long term.

5.4 Restoration/Enhancement Plans and Actions

Based on September 22 and October 16, 1995 field visits to each restoration and enhancement site, the Technical Committee identified appropriate “restoration actions” for each site. These actions are listed in Table 5.3 and include:

Tidal Restoration Actions:

- Restore to full tidal regime;
- Restore tidal emergent habitat;
- Remove maximum dike area to maximize tidal exchange and facilitate the sediment accretion process;
- Grade dike down to provide natural shelf transition from river slough to wetland and create islands out of remaining dike areas;

- Reconnect tidal streams and sloughs;
- Excavate channels to “pre-dike depths;”
- Facilitate natural dendritic channel formation. Circulation design should be based on hydrological analysis and may include filling in of existing ditches;
- Restore and enhance minimum 25-foot inland edge of buffer for tidal wetland;
- Restore scrub-shrub and forested habitat;
- Restore to partial tidal in order to protect existing significant non-tidal palustrine habitat. Site culverts at higher elevations rather than breach dike. Culverts should be designed to allow fish access and minimize fish stranding;

Non-Tidal Restoration Actions

- Maintain existing significant area of scrub-shrub and forested habitat;
- Restore and enhance minimum 25-foot “edge-of-field” areas and stream buffers with scrub-shrub buffer habitat -- concentrate on areas where such buffer scrub-shrub habitat would reconnect larger Group 1 wetlands;
- Maintain and/or enhance existing palustrine emergent habitat including existing areas of open water; and
- Manage as non-tidal palustrine wetland, with seasonal flooding increased to a minimum of 25% of the wetland area.

The identified actions for each restoration and enhancement site constitute the basic restoration and enhancement plans. Any changes to these plans beyond those actions identified must be approved by the Snohomish Estuary Technical Oversight Committee (see Compensation Policy G.6).

Because elevation will be critical to the type of plant community and whether plant communities will establish in tidal restoration sites, it is important that exact elevation surveys be performed in proposed tidal restoration sites and adjacent functioning tidal wetlands. This survey should include soil salinity and soil texture data. Hydrological modeling of the restoration site must also be performed to ensure that full tidal exchange is attained.

5.4.1 Basis for Selecting Restoration Actions. Particular attention was paid to the potential sediment accretion rate for the Estuary when developing the restoration actions, because it affects elevation, which controls the type of estuarine habitat that will be present. Frenkel and Morlan (1990) found that sediment accretion was highest in those areas that had the greatest degree of tidal exchange. This typically occurred around tidal creeks. The least amount of sediment increase occurred in areas which still had dikes in place. Frenkel and Morlan also

found that tidal creeks were a major determinant in marsh hydrology (Frenkel 1990). Their study also demonstrated that sediment accretion was the slowest in areas located behind long portions of remnant dike.

On the basis of this work, the restoration actions recommend that the maximum practicable length of dike be removed for tidal restoration and that old sloughs and tidal creeks be re-connected with the main tidal channel by over-excavating where the old sloughs and tidal creeks cross the former dike location. Complete removal of the dike, or a large breach, will also allow for the accumulation of large woody debris, which will increase wetland elevation in severely subsided areas and allow for the formation of a more diverse wetland plant community.

Other actions for facilitating dendritic channel formation are based on work demonstrating that fish and macroinvertebrate use is a function of marsh edge to area, and general observations that these channels increase fish access to intertidal marshes (Simenstad 1995).

Actions providing for the creation of scrub-shrub and forested habitat are designed to reduce habitat fragmentation and patchiness and increase buffering adjacent to high- and medium-value habitat areas. Overall, implementation of these measures would provide a complete link from the mouth of the Estuary to the southernmost portion of the study area.

Restoration and enhancement actions for waterbird habitat (increase flooding to 25% of site area) were based on work by Brennan (1985) and Shreffler and Thom (1993) demonstrating that agricultural fields provided important feeding and resting habitat for overwintering waterfowl (see section 5.2.2).

5.5 Development Footprint

The process for identifying the development footprint involved three steps. The User Group first identified the “draft” footprint based on results of the IVA model (wetland and mudflat habitat assessment), including assessment of social significance functions. The second step was calculation of the development “debits” from the IVA scores and comparison of those debits to the “credits” that would be gained from the restoration and enhancement actions. Because the restoration and enhancement credits were greater than the “debits” generated by the development footprint, the development footprint selected by the User Group (June 15, 1995 meeting) was then known to be feasible. As a final step the SETAC reviewed the development footprint during May 1995 and excluded Maulsby Mudflat based on extensive use of the area by migrating shorebirds, waterfowl and pisciveous birds (e.g. bald eagle, osprey and great blue heron). Appendix M contains a more detailed description of the wildlife usage of Maulsby Mudflat. The final footprint is presented in Figures 5.4A and 5.4B.

Table 5.3 SEWIP Restoration Plans for Each Restoration Site

Site Location	Dike Areas			Tidal Streams and Sloughs			Buffer & Habitat Structure						Hydrological Regime		
	Removal of maximum area of dike	*Grade dike down to provide natural shelf transitions from river-slough to wetland*	*Create islands out of remaining dike areas*	*Reconnect remnant tidal streams and sloughs*	*Excavate channels to "pre dike depths"*	*Facilitate natural dendritic channel formation - fill interior drainage ditches, leave larger peripheral ones*	*Restore and enhance minimum 25 foot inland edge of buffer for tidal wetland*	*Restore and enhance minimum 25 foot "edge of field" and exist. streams with scrub-shrub buffer habitat for agricultural wetlands in order to connect larger habitat "patches"*	*Restore scrub-shrub and forested habitat*	*Maintain existing significant areas of scrub-shrub and forested habitat (non-tidal)*	*Restore tidal emergent habitat*	*Maintain and/or enhance existing non-tidal palustrine emergent habitat including existing areas of open water*	*Restore to full tidal regime*	*Restore to partial tidal in order to protect existing signif. non- tidal palustrine habitat. Site culverts at higher elevations rather than use dike break. Culverts should be designed to allow some fish passage.*	*Manage as Non- Tidal Palustrine Wetland with seasonal flooding increased to a minimum of 25% of wetland*
1) Poortinga, WC 146,147,339-343, 360-363	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	-	Yes	-	-
2) N. Spencer (Biringer Farm) WC 268, 295-301, 303-306.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	-	Yes	-	-
2A) Agricultural Lands South of Nyman. WC 124, 130, 178, 210-213, 215, 217-220, 221-226, 229, 326, 327, 337, 338, 333-335, 358.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	-	Yes	-	Yes
3) South Ebey north of Hwy 2, Alter 2, WC 102, 103, 104, 106-108, 110-115, 348	Yes [1]-.	Yes	Yes[2] -.	Yes-	Yes	Yes	Yes	-	-	See Footnote # 3.	Yes	-	Yes	-	-
4) South Ebey north of Hwy 2, Alter 1. WC 103, 104	Yes[1-.	Yes	Yes[2] -.	Yes-	Yes	Yes	Yes	-	-	- See Footnote # 3:	Yes	-	Yes	-	-
4A) East Smith Island. WC 31, 32, 32.1, 34-40, 42, 42.1 43, 98, 99, 345,	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes		Yes	-	-
5) Nyman Farm . WC 139		-	-	Yes - Limited connection thru culverts	-	Yes	Yes	-	-	Yes	Yes	Yes - Some exist emerg. in Forested area	-	Yes	-
7) Drainage District 6 North of City of Everett water line. WC 230-233, 235-241, 245, 331, 332	Yes	Yes [4]	Yes	Yes	Yes	Yes	Yes	-	-	See Footnote #5	Yes	-	Yes		-

1 - Note: group did not agree on how far south tidal inundation should occur, so two alternatives were selected which will be run through Tech & Economic Criteria/
2 - Additional islands would be created in the interior from ditch sidecasting etc. to create new Sitka Spruce habitat that would be lost from tidal flooding.
3 - It was decided that this would be very difficult to design and maintain existing forested habitat. Thus snags will be created and new scrub/shrub & forested habitat created on islands and sidecasting from ditches.
4 - Limited to areas where dike is removed because dike will be used for pedestrian access.
5 - Existing scrub-shrub habitat will be inundated & will die off (snags will be created) on WC 232, 245, & 332..

Table 5.4 SEWIP Enhancement Plans (Non Regulatory)

	Dike Areas			***Tidal Streams and Sloughs***			***Buffer & Habitat Structure***						***Hydrological Regime***		
Site Location	*Removal of maximum area of dike*	*Grade dike down to provide natural shelf transitions from river-slough to wetland*	*Create islands out of remaining dike areas*	*Reconnect remnant tidal streams and sloughs*	*Excavate channels to "pre dike depths"*	*Facilitate natural dendritic channel formation - fill interior drainage ditches, leave larger peripheral ones*	*Restore and enhance minimum 25 foot inland edge of buffer for tidal wetland*	*Restore and enhance minimum 25 foot "edge of field" and exist. streams with scrub-shrub buffer habitat for agricultural wetlands in order to connect larger habitat "patches"*	*Restore scrub-shrub and forested habitat*	*Maintain existing significant areas of scrub-shrub and forested habitat (non-tidal)*	*Restore tidal emergent habitat*	*Maintain and/or enhance existing non-tidal palustrine emergent habitat including existing areas of open water*	*Restore to full tidal regime*	*Restore to partial tidal in order to protect existing signif. non-tidal palustrine habitat. Site culverts at higher elevations rather than use dike break. Culverts should be designed to allow some fish passage.*	*Manage as Non- Tidal Palustrine Wetland with seasonal flooding increased to a minimum of 25% of wetland*
3A) South Ebey WC 60,61 63, 66, 69								Yes	Yes	Yes		Yes			Yes
6) South Ebey, S. of Hwy 2, WC 81,	-	-	-	See Footnote #1	-	-	-	Yes	-	Yes	-	Yes	-	See Footnote 1.	Yes
6A) South Ebey, S. of Hwy 2, WC 81	-	-	-	See Footnote #1	-	-	-	Yes	Yes[2]	Not on site. Present to south on WC 83		Yes		See Footnote 1.	Yes
6C) Swan Slough Agric. WC 251, 252	-	-	-	-	-	-	-	Yes	-	- None	-	Yes	-	-	Yes
8) Swan Slgh WC 253	-	-	-	-	-	-	Yes	-	? May be possible		Yes	-	-	Yes	-
9) South Ebey WC 83, Fish & Wildlife Prop. - ***Manage site as is***	-	-	-	-	-	-	-	Yes [3]-	-	Yes	-	Yes	-	-	-
10) Diking Dist. 6, South of City of Everett water line. WC 96, 242, 243, 246-249	-	-	-	-	-	-	-	Yes	Yes	Yes [4] -	-	Yes	-	-	Yes
11)Southern half of S. Ebey. WC 57, 58, 64, 65, 72, 73, 75, 76, 78-80, 82, 85-95, 97, 100, 346	-	-	-	-	-	-	-	Yes	-	Yes	-	Yes	-	-	Yes
12) Southwest portion of S. Ebey. WC 64-65	-	-	-	-	-	-	-	Yes	Yes [5].	Yes	-	-	-	-	Yes
13) Southwest portion of S. Ebey, WC 206	-	-	-	Yes [6]	-	-	-	Yes [7]	-	-	-	-	-	Yes [8]-	
14) Marshland. WC 193, 195-197, 198-205, 207, 208, 209, 262-265, 318-321, 322-325, 329, 330	-	-	-	-	-	-	-	Yes	-	Yes - limited to WC 193, 196, 199,202	-	Yes	-	-	Yes

1 - Depending on feasibility consideration of limited fish passage in old tidal sloughs should be considered..
2 - Would be limited to no more than 10% of site (on higher lands located on the eastern and southern edges).
3 - The edges of agricultural lands to west, north and south can be restored to scrub/shrub habitat (implementation of this action is dependent on cooperation of these adjacent owners).
4 -. The scrub-shrub vegetation. is limited to north-east corner of WC 96 & 242.
5 - Western upland edge would be expanded significantly (+100 feet) to provide wildlife corridor.
6 - An existing ditch with a tide gate could be reconnected to the wetland on WC 206.
7 - Would require cooperation of owner on WC 67 which is agricultural land.
8 - Existing scrub-shrub habitat dominated by Pacific willow would not be negatively impacted by tidal flooding because tidal waters are essentially fresh water at this location.

5.6 Restoration/Enhancement Credits

The restoration and enhancement sites with the identified "restoration/enhancement actions" were re-scored with the IVA model. The restoration/enhancement credits were calculated by subtracting the existing IVA score for the specific wetland complex from the new restoration/enhancement score. By comparing these credits to the total possible debits from filling the development footprint, SETAC determined that there were adequate restoration/enhancement credits (compensation) to offset the impacts or debits of the development footprint. For example, Table 5.5 demonstrates that the restoration/enhancement credits for the number one priority restoration site, the Poortinga property, are sufficient to offset all of the development footprint impact debits.

Table 5.5 Development Debits and Restoration Credits for Vegetated Wetlands

Site	Impacts to Water Quality Functions in Acre Points	Restoration Credits for Water Quality Functions in Acre Points	Impacts to Wildlife Functions in Acre Points	Restoration Credits for Wildlife Functions in Acre Points
Development Footprint for Vegetated Wetlands	10,761	None	4500	None
Priority #1 Restoration Site, Poortinga Property	None	16,350	None	18,326

The credits for both the restoration and enhancement of mudflats were also found to offset potential development impacts. For the enhancement of mudflats, however, the SETAC concluded that the benefit derived from removing log-rafts could not offset the loss of mudflat habitat through filling because: (1) the mudflat habitat was already present in the system and provided some functions because rafting was cyclical; and (2) mudflat habitat is more limited in the Estuary, and there is less potential for restoration than for vegetated wetlands. Therefore, SETAC developed a policy which required a 1:1 restoration or creation of mudflat habitat within the Estuary.

5.7 Compensation Ratios

With adequate compensation credits available in the Estuary, SETAC turned next to calculating the appropriate compensation ratios. By examining the average increase for the Water Quality Improvement and Wildlife Functions for each restoration and enhancement site, and comparing that increase to the impact debits for the corresponding functions in the Development Footprint, the overall compensation ratio was determined.

Table 5.6 presents the calculated replacement ratio based on the Chapter 2 compensation policies for the top-ranked restoration sites for vegetated wetlands.

The compensation ratios in Table 5.6, based on the actual IVA scores and compensation policy G.3A, were less than 1:1. In these circumstances, SETAC required that a minimum 1:1 replacement acreage be provided. This ratio is based on existing state and federal policies of no net loss of function and acreage. Table 5.7 lists the actual IVA scores for the development footprint and restoration sites that were used to calculate the compensation ratios in Table 5.6. More detailed examples of the actual IVA scores for the development footprint and restoration sites and the calculated compensation ratios are provided at the end of Chapter 2 and in the meeting staff reports and minutes (Appendix A, available separately).

Table 5.6 Summary of Calculated Compensation Ratios for Snohomish Estuary Vegetated Wetlands (Policy G.3A)

Based on One Acre of Impacted Wetland in Development Footprint

Restoration Priority and Location	Final Compensation Ratio Required Based on General Compensation Policies (based on 1:1 minimum and 25% increase to account for temporal loss)
Priority 1 -- Poortinga	**1:1**
Priority 2 -- N. Spencer (Biringer)	**1:1**
Priority 3 -- E. Smith Island	**1.2:1**
Priority 4 & 4A -- East Mainland	**1.5:1**

Table 5.7 Calculated Compensation Ratios for Snohomish Estuary Vegetated Wetlands (Policy G.3A)

Based on 1 Acre of Impacted Wetland in Development Footprint

Restoration Priority and Location	Wetland Function	Average Performance of Functions for Develop-ment Footprint (per acre)	Average Increase in Performance for Restoration/ Enhance-ment Area. (per acre)	Acres Required to Offset Develop-ment Impacts Based on Column 3 divided by Column 4	Acres Required to Offset Development Impacts Based on Chapter 2 Compensation Policies	Final Compensation Ratio Required Based on General Compensation Policies in Chapter 2. Calculated by dividing column 3 by column 4 for the limiting functions and increasing product by 25% to account for temporal habitat loss. Minimum Compensation Ratio must be 1:1.
Priority 1 - Poortinga	Wildlife	13	57	0.2 acres	not the limiting function	not the limiting function
Priority 1 - Poortinga	Water Quality	31	51	0.6 acres	**1 acre**	**1:1**
Priority 2 - N. Spencer (Biringer)	Wildlife	13	54.5	0.2 acres	not the limiting function	not the limiting function
Priority 2 - N. Spencer (Biringer)	Water Quality	31	41.8	0.7 acres	**1 acre**	**1:1**
Priority 3 - E. Smith Island	Wildlife	13	51.2	0.3 acres	**not the limiting function**	not the limiting function
Priority 3 - E. Smith Island	Water Quality	31	32.8	1.2 acres	**1.2 acre**	**1.2:1**
Priority 4 & 4A - East Mainland	Wildlife	13	53.4	0.2 acres	not the limiting function	not the limiting function
Priority 4 & 4A - East Mainland	Water Quality	31	26.6	1.2 acres	**1.5 acre**	**1.5:1**

GLOSSARY OF TERMS (SEWIP and Wildlife Analysis, Appendix G)

Attributes - Characteristics that are correlated with and can serve as indicators of ecosystem structure and function (Aronson et al. 1993)

Alcids - Short winged pelagic birds that only come ashore to breed. They use their wings to swim underwater. Includes auks, murres and puffins.

Anadromous - Saltwater fish that enter fresh water to spawn, ascending rivers from the sea for breeding. Salmon and steelhead are examples of Pacific Northwest anadromous fish.

Angiosperms - Flowering vascular plants having seeds in an enclosed ovary.

Areal cover - Means the % of vegetation covering any area of vegetated wetland. It is used to decide what classes are present in a wetland. Areal measurements are those made as if the wetland was being viewed from the air.

Assemblage - A naturally occurring group of plants (flora) and animals (fauna) that occur together within the Estuary based on biological, physical and chemical requirements of these organisms.

Aquatic bed wetland class - Means any area of open water with rooted aquatic plants such as lily pads, pondweed, etc., that grow principally on or below the surface of the water for most of the growing season in most years.

Biodiversity - The diversity of living things. Often used to identify how many species are living in a particular area.

Brackish - A salinity term that is typically applied to inland waters of intermediate salinity. The term "mixosaline" is more universally accepted, however.

Coniferous - Containing conifers (firs and evergreen trees), as in "a coniferous forest."

Conversion - Transformation of an ecosystem into a different ecosystem type or land use (i.e.:- conversion of a wetland for construction of a mall). Causes complete loss of the original ecosystem functions.

Creation - Bringing into being a new ecosystem that did not exist on the site (NRC 1992). For example, constructing a wetland on an upland site where wetlands did not previously exist would be creation (compare with restoration).

Cumulative effects or impacts - The sum of all individual impacts occurring over time and space, including those of the foreseeable future.

Degradation - Partial loss of functions in a particular habitat caused by impacts that act on an ecosystem without causing conversion to another habitat type or development (e.g. reductions in productivity in a habitat because of inputs of pesticides through nonpoint source pollution.). Please see definition of "ecosystem functions".

Dendritic channels - The branching, treelike side channels of open water that are present in tidally influenced mudflats, saltmarshes and fresh water marshes.

Disturbance - Any relative discrete event in time that disrupts the ecosystem, community, or population structure, and changes resources, substrate availability, or the physical environment (Picket and White 1985).

Drainage area - See "watershed".

Ecosystem - All of the biotic elements (i.e., species, populations, and communities) and abiotic element (i.e. land, air, water, and energy) interacting in a given geographic area, such that a flow of energy leads to a clearly defined trophic structure, biotic diversity and materials cycle (Odum 1971).

Effect - A physical, chemical, or biological change in an ecosystem that results from an impact. The effect can be an immediate consequence of the impact (direct effect), or it can be removed in time and space (indirect effect).

Emergents (plants) - A plant rooted in shallow water and having most of the vegetative growth above water. Erect, rooted herbaceous plants that can tolerate flooded soil conditions, but cannot tolerate being submerged for extended periods (e.g. - rushes, sedges and grasses)

Emergent wetland class - A wetland class consisting of non-woody plants (emergent plants such as cattails, rushes and sedges) and comprises at least 30% areal coverage of the subject wetland. Emergent wetlands include marshes and wet meadows.

Enhancement - The alteration or active management of a wetland for improvements of a particular function or functions.

Epibenthic organisms - Small crustaceans (zooplankton) that are found in large populations on marine algae and rocky/hard substrates.

Estuary - Upstream and landward to where ocean-derived salts measure less than 0.5% during a period of average annual low flow and; 1) seaward to an imaginary line closing the mouth of river, bay or sound or; 2) the seaward limit of wetland emergents, shrubs, or trees not included in #1 above; and 3) offshore areas of continuously diluted sea water.

Estuarine wetlands - Wetlands located within an estuary (see definition above).

Function (ecosystem or ecological) - Is a single ecological process or a combination of processes, including biological, physical or a chemical processes. For example, an estuary ecosystem consists, in part, of the "water quality improvement," "flood control improvement," "primary productivity," "fisheries habitat," "bird habitat," "small and large mammal habitat," and "invertebrate habitat" functions. The "water quality improvement" function consists of several physical, chemical and biological process that act in concert to maintain the quality of water at a level which maintains the species commonly found within that particular habitat type. These processes include the physical removal of sediment from water through settling in slower flowing portions of wetlands brought about by the complementary actions of vegetation and physical configuration of the wetland basin. Chemical processes involve the adsorption of pollutants to sediment particles particularly in anaerobic (low oxygen) conditions. Biological

processes involve the uptake of nutrients such as phosphorous and nitrogen and bacterial processes in aerobic muds such as the denitrification where nitrogen is released to the atmosphere as a gas. Definition of the wetland functions assessed in this study are presented in Chapter 3 of this SEWIP document.

Fluvial - Of, or relating to, or living in a stream or river. Produced by stream action.

Forested wetland class - A wetland class which consists of trees taller than 20 feet (e.g.:- Sitka spruce, Western red cedar, Oregon ash, red alder and black cottonwood.) and covers at least 30% of the areal cover of the wetland. Water-tolerant shrubs such as black twinberry, ninebark, nootka rose, red-osier dogwood often form a second layer beneath the forest canopy, with a layer of herbaceous plants represented by skunk-cabbage growing beneath the shrubs.

Fragmentation - The break-up of a single ecosystem type into a number of smaller patches of the historic habitat through development activities including farming, industry, commerce and residential development.

Function loss - Refers to the complete or partial loss of one or more ecological functions as a result of impacts. Also refers to one of the four synoptic indices established by the EPA for landscape assessment (EPA 1992).

Guild development - A process based on scientific consensus to identify an assemblage of species that is representative of a particular ecosystem or community within an ecosystem. The process involves the identification of certain species within an ecosystem or community, based on their physical, chemical and biological requirements and their interrelationship with each other. This also includes agreed upon criteria, such as breeding and feeding strategies. Typically faunal (animal) species are identified as the "guild species." This process requires intensive sampling and trapping programs, identification of life histories of each species and water quality analysis.

Guild (of species) - See "guild development."

Habitat function - The environment occupied by individuals of a particular species, population, or community (Kusler and Kentula 1990).

Habitat fragmentation - The result of human activities that fragment natural ecosystems into fewer and smaller pieces (Weins 1985).

Historic condition - A condition known to have previously existed in the estuary from historic or recent paleoecological evidence; this definition assumes prior human disturbance in the ecosystem (Shreffler and Thom, 1993).

Habitat Evaluation Procedures (HEP) - A species-habitat evaluation protocol developed specifically in 1976 (revised in 1980) to assess only those wildlife species that will be impacted by a proposed development. The protocol process consists of: compiling general fish and wildlife data for study area; delineating habitat cover types; selecting evaluation species; and documenting habitat quality for the selected evaluation species by means of a Habitat Suitability Index (HSI).

Herbaceous - Of, relating to, or having the characteristics of an herb. Of a stem, having little or no woody tissue and persisting usually for a single growing season. Having the texture, color, or appearance of a leaf.

Herptile - A cold-blooded vertebrate; includes reptiles and amphibians.

Hydric soil - A soil that is saturated long enough during the growing season to develop anaerobic (oxygen lacking) conditions in the upper part of the soil. Hydric soils are generally classified as poorly drained or very poorly drained.

Hydrography - The description and study of bodies of water. The measurement of flow and investigation of the behavior of streams, especially with reference to the control of their waters. The charting of bodies of water.

Hydrophyte/hydrophytic - Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Habitat Suitability Index (HSI) - HSI is developed under the HEP protocol (see definition above). It establishes the level of habitat quality for a particular species and is based on field measurements of habitat structure (vegetative densities, diversity and size[dbh] within a study area relative to known optimal habitat structure for that species. The HSI values are then multiplied by the area of available habitat to obtain Habitat Units. From this value it can then be determined what project alternative have the least impact and what type and quantity of mitigation should be provided.

Infaunal - Pertaining to benthic fauna living in aquatic substrate, such as muscles and clams found in an estuarine mudflat.

IVA Model - Indicator Value Assessment Model (See Chapter 4). A habitat assessment protocol that measures the performance of wetland functions in a semi-quantitative manner, allowing for the comparison of the level of performance of wetland functions for all wetlands assessed within a defined study area. Uses “indicators” to determine if functions are being performed. Wetlands with a greater number of indicators are considered to be performing the function better than a wetland with fewer indicators present for the particular function.

Landscape - "A heterogeneous land area composed of a cluster of interacting ecosystems that is repeated in a similar form throughout" (Forman and Godron 1986.) A landscape is normally defined by geomorphology or climate. The study boundary for a synoptic assessment need not include the entire landscape.

Landscape ecology - The study of interactions between ecosystems.

Landscape indicator - The actual data or measurements used to estimate a synoptic index (see synoptic); in the synoptic approach, a landscape indicator is usually a first-order approximation based on existing data.
Life form - A complete summary of the habitat requirements for feeding, breeding and resting habitat for wildlife species.

Long-Term - Ten years or longer.

Management indicator species - Based on rigorous habitat/species studies, these are single species or a group of species that are assumed to be indicative of a "healthy functioning" ecosystem for a particular habitat type. In theory, "management" of the habitat type to protect the management indicator species will result in protection of all species typically found in that habitat type.

Marsh - An emergent wetland that is flooded either seasonally or permanently and can be tidally or nontidally influenced. Marshes support the growth of emergent plants such as rushes, sedges, grasses, floating-leafed plants such as pondweeds, and submergents.

Mitigation - Actions taken to avoid, reduce, or compensate for the effects of environmental damage. Among the broad spectrum of possible actions are those that restore, enhance, create, or replace damaged ecosystems (NRC 1992).

MLLW - Mean Lower Low Water - Represents "0" feet under a tidal measurement system that averages the lower of the two unequal daily low tides observed on a daily basis for 19 years.

MLHW - Mean Lower High Water - Represents "+9.39" feet in the Snohomish Estuary under a tidal measurement system that averages the lower of the two unequal high tides observed on a daily basis over a 19 year period.

MHHW - Mean Higher High Water - Represents "+11.11" feet in the Snohomish Estuary under a tidal measurement system that averages the higher of the two unequal high tides observed on a daily basis over a 19 year period.

Monitoring - Periodic evaluation of a restoration, creation, or enhancement site to determine success in attaining goals that have been specifically set forth for the site. The goals must also include specific monitoring criteria such as acceptable levels for chemical constituents in the wetland, and plant type, diversity and coverage percentages.

Open water wetland class - Any area of sanding water present for more than one month at any time of the year without emergent, scrub-shrub or forested vegetation. Open water includes any aquatic beds that are smaller than 1/4 acre.

Palustrine wetlands - All nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens and all such wetlands that occur in tidal areas where salinity due to ocean salts is less than 0.5%.

Passerines - Smaller resident and migratory birds, like songbirds and finches.

Patch - An irregularly shaped ecosystem embedded within a larger "matrix" ecosystem.

Patch distance - The distance between two patches or, more generally, the average distance between patches in an area.

PHS Program - Priority Habitat and Species Program establishes specific definitions for Priority Species and Areas including game species (waterfowl) and species of ecological importance such as the pileated woodpecker, great blue heron, Columbia black tailed deer and mink. Includes all federal or state listed or candidate threatened, endangered or sensitive species. The Department of Fish and Wildlife is responsible for inventorying, monitoring and protecting these species.

Predisturbance condition - The condition thought to have previously existed in the estuary prior to the onset of human disturbance.

Rapid bioassessment - Any method used to quickly detect and assess the performance of ecosystem functions or to detect and assess environmental impacts.

Raptors - Birds of prey; examples are hawks, eagles and falcons.

Reference ecosystem - An existing, indigenous ecosystem that is used as an ecological yardstick for the purposes of project design and evaluation.

Redundancy - The ability of an ecosystem to perform functions in more than one way, or an excess capacity or structure beyond what is normally needed. Redundancy buffers an ecosystem from impacts.

Restoration - Return of an ecosystem to a close approximation of its previously existing condition (modified from NRC 1992). For example, building a wetland on a non-upland site where a wetland previously existed would be considered restoration.

Riparian - Those areas associated with streams, lakes and wetlands where vegetation communities are predominantly influenced by their association with water. Typically a transition area between aquatic and terrestrial ecosystems. It can include naturally non-vegetated areas like rocky canyon walls or gravel bars immediately adjacent to a stream or river.

Scrub-shrub wetland class - A wetland class consisting of shrubs and woody plants less than 20 feet tall, (i.e.:- dogwoods, red alders, ninebark etc.) that comprise at least 30% of the areal coverage of the wetland. Water levels in scrub-shrub swamps can range from permanent to intermittent flooding.

Section 404 - The portion of the Clean Water Act that specifies that a permit must be obtained to discharge dredged or fill materials into waters of the United States.

Sediment accretion - A natural process of lakes, streams and rivers whereby layers of sediment are laid down on top of each other during flooding or normal sediment transport activities. This process ultimately results in the creation of new land, as in deltas, or mud flats.

Self-maintaining system - An ecosystem that can perform all of its natural functions without human intervention or dependence on engineered structures (NRC 1992).

Stress - The immediate physical, chemical and biological changes that result from a disturbance.

Stressor - Same as a disturbance.

Structure - The physiognomy of an ecosystem, which is generally expressed in terms of life forms, vertical stratification, and size of the dominant plants.

Submergent - Plants that grow and reproduce while completely submerged in water.

Subsided/subsidence - To sink, or fall to the bottom, settle. To flatten out so as to form a depression.

Substrate - The base on which an organism lives. The soil is the substrate of most seed plants.

Success - Achieving established goals. Success in wetland restoration, creation and enhancement ideally requires that criteria, preferably measurable as quantitative values, be established prior to commencement of these activities (Kusler and Kentula 1990).

Swamp - A wetland in which the soil is saturated and often inundated and that is dominated by a forested class (such as Sitka spruce, alder or cedar).

Study unit - The actual geographic boundary of a synoptic assessment. May be based on political (i.e.:- a state), or environmental (i.e.:- a geological province) criteria.

Synoptic approach - A five step approach established by the EPA to assessing cumulative impacts or environmental risk, that provides a broad overview of environmental and landscape factors.

Synoptic assessment - The process of following the five steps of the synoptic approach in order to produce a set of maps, data and reports that can be used to assess cumulative impacts or environmental risk. The SEWIP document is a synoptic assessment.

Synoptic index - A landscape variable that is used in a synoptic assessment as a basis for comparing landscape subunits. There are four general synoptic indices (function, value, functional loss, and replacement potential); in an actual assessment a specific index would be defined for one or more of the general indices.

Taxa - Plural of taxon, a taxonomic group or entity, a scientific classification of plants and animals according to their presumed natural relationships.

Travel distance - The maximum distance an organism can travel in order to reach suitable habitat. An organism cannot travel to a different patch if the patch distance is greater than the travel distance.

Value - Refers to the benefits obtained by individuals or society from an ecological function. Could include benefits received indirectly, i.e.:- when the function acts on something of value (example, flood reduction is valuable because it reduces loss of life and loss of valued property.) One of the four synoptic indices developed by the EPA for landscape analysis (EPA 1992).

Vascular (Plant) - A plant having a specialized conducting system that includes xylem and phloem.

Water quality function - Ecological processes that, when taken together, improve water quality; i.e.:- reduce pollutant concentrations, remove sediments from the water column, and contribute to nutrient cycling.

Watershed - A natural drainage unit defined by topographic high points (usually mountain ridges or other water divides) within which the only input of water is precipitation. Used analogously with drainage area, although the latter is more properly defined relative to some

specific point; i.e.:- the drainage area for some particular point on a river includes all the area that collects precipitation that is ultimately routed through that point on the river.

Wetland - Any ecosystem characterized by the presence of water; unique soils compared with adjacent uplands; the presence of vegetation adapted to wet conditions; and the absence of flood-intolerant vegetation (Mitsch and Gosselink 1986). In a more limited sense, used to specifically refer to those wetlands that are included under Section 404 of the Clean Water Act ("jurisdictional wetlands").

Wet meadow - Emergent wetlands that are generally seasonally flooded and have saturated soils for much of the growing season. Wet meadows are dominated by grasses, sedges and rushes and are often cultivated or pastured.

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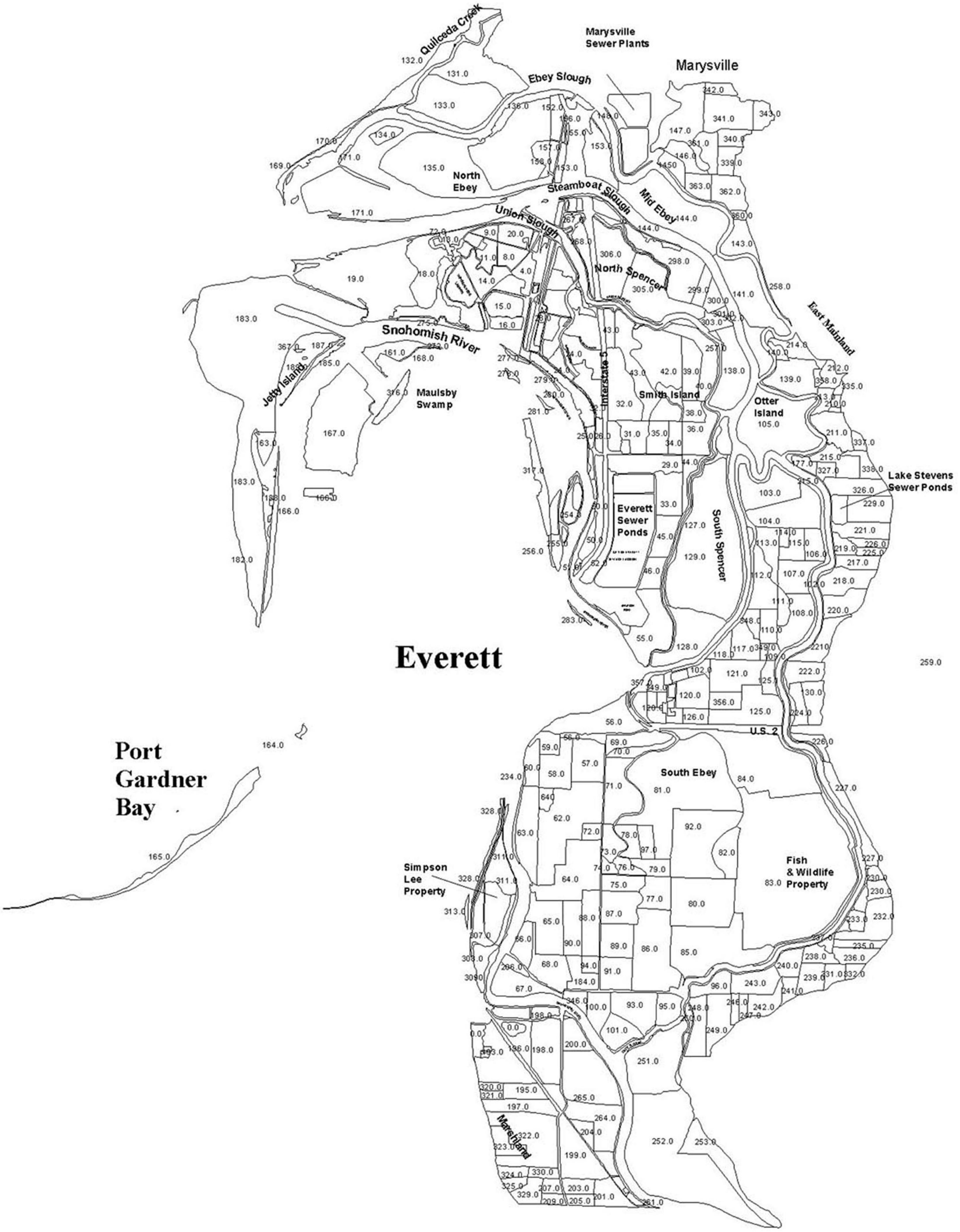
1997 SEWIP Wetland Complex Numbers



Appendix B

IVA Model, Sample Inventory Sheet, Paper on IVA Protocol

IVA For EVERETT VEGETATED WETLANDS{private }
FIELD QUESTIONS
'Y' = indicator is present in the wetland
'-' = indicator is absent in the wetland
WETLAND #_____LOCATION_____
Initials of field crew_____ DATE_____

WATER REGIME

	1	Source of water - tidal
	2	Source of water - stream
	3	Source of water - springs, seeps, not evident
	4	Most of wetland (>50%) is below Mean Higher High Water (<11)
	5	Most of wetland (>50%) is above Mean Higher High Water but water regime is still tidal
	6	Wetland has only slow water velocities <10 cm/sec (1/3 ft/sec)
	7	Wetland has a range of water velocities present in channels, streams, or surface flow
	8	Wetland has a permanent, unobstructed, natural inlet (may be culverted stream)
	9	Wetland has no outlet
	10	Wetland has a permanent outlet
	11	Flow in outlet is restricted and manmade (e.g. tide gate)
	12	Flow in outlet is restricted and natural (e.g. beaver dam, log jam)
	13	Outlet is >1/3 the average width of the wetland
	14	Wetland flooding is primarily overbank (vs rising groundwater or rainfall)
	15	Wetland has a dendritic channel system
	16	Wetland contains a channel (ditches included) or stream
	17	Channel or stream is sinuous (channel length is more than 2 times its straight line distance)
	18	The wetland floods at least once per year
	19	The wetland floods between once every year and once every 5 years
	20	The wetland is in the 100 year floodplain (FEMA)
		Check off the hydroperiod that best describes the largest area in the wetland
	21	Dominant hydroperiod = permanently flooded nontidal
	22	Dominant hydroperiod = intermittently exposed nontidal
	23	Dominant hydroperiod = seasonally flooded nontidal
	24	Dominant hydroperiod = saturated nontidal
	25	Dominant hydroperiod = temporarily flooded nontidal
		Check off the hydroperiod of the wettest area in the wetland
	26	Wettest hydroperiod = permanently flooded nontidal
	27	Wettest hydroperiod = intermittently exposed nontidal
	28	Wettest hydroperiod = seasonally flooded nontidal
	29	Wettest hydroperiod = seasonally flooded nontidal
	30	Wettest hydroperiod = seasonally flooded nontidal
	31	The wetland is freshwater tidal
	32	The wetland is estuarine tidal
	33	The wetland has permanent open water on 1 - 10% of its area
	34	Permanent open water 10 - 25% of wetland
	37	Permanent open water 90 - 100% of wetland
	38	Wetland has seasonal open water on 1 - 10% of its area (at least 2 months a year,
		does not include permanent open water)
	39	Seasonal open water 10 - 25% of wetland
	40	Seasonal open water 25 - 75% of wetland
	41	Seasonal open water 75 - 90% of wetland
	42	Seasonal open water 90 - 100% of wetland

WATER REGIME (continued)

	43	Check off water depths in at least	6 - 36 inches
	44	5% of OPEN WATER areas, present	36 - 60 inches
	45	at least seasonally	>60 inches
	46	Check off the water depths present in	<1 inch
	47	at least 5% of the areas with	1 - 6 inches
	48	EMERGENT vegetation, at least	6 - 24 inches
	49	seasonally	24 - 60 inches

PHYSICAL FEATURES

	50	Islands are present in wetland
	51	Interspersion between vegetation and water is solid (see Figure 1)
	52	Vegetation-water interspersion is intermediate (Figure 1)
	53	Vegetation-water interspersion is mosaic (Figure 1)
	54	The edge between upland and wetland is irregular (Figure 2)
	55	Wetland has areas of vegetation or open water protected from winds
	56	Open waters or shores of wetland are protected by waves
	57	Shores in wetland along streams, channels, or open water have overhanging vegetation
		>50% of their length
	58	Shores have overhanging vegetation along 20 - 50% of length

SOILS (check off all appropriate soil types)

	59	Wetland has organic soils on >25% of area
	60	Sand >25% of area
	61	Mud >25% of area
	62	Substrate impacted by wood waste on >25% of area

VEGETATION CLASSES (as defined by Cowardin, 1979)

Dominant vegetation class (covers >50% of vegetated area, excluding open water

	63	Dominant class: Forest with canopy trees above 50'	1 species
	64	(check off # of tree species in high canopy)	2-3 species
	65		>3 species
	66	Dominant class: Forest with canopy trees 20'-50'	1 species
	67	(check off # of tree species in 20'-50' range)	2-3 species
	68		>3 species
	69	Dominant class: Scrub-shrub	1 species
	70	(check off # of scrub-shrub species)	2-3 species
	71		>3 species
	72	Dominant class: Emergent	1 species
	73	(check off # of emergent species that cover	2-3 species
	74	>5% of area of emergent vegetation)	3 species
	75	Dominant emergent is reed canary grass (>80% coverage)	
	76	Dominant class: Aquatic bed	1 species
	77	(check off the number of aquatic bed species)	2-3 species
	78		>3 species

Secondary vegetation classes covering 10% - 50% of vegetated areas, excluding open water

	79	Secondary class: Forest (trees >20')	1 species
	80	(check off # of tree species present)	2-3 species
	81		>3 species
	82	Secondary class: Scrub-shrub	1 species
	83	(check off # of scrub-shrub species)	2-3 species

	84		>3 species
	85	Secondary class: Aquatic bed	1 species
	86	(check off # of aquatic bed species)	2-3 species
	87		3 species

	VEGETATION CLASSES (continued)		
	88	Secondary class: Emergent	1 species
	89	(check off # of emergent species that cover	2-3 species
	90	>5% of area of emergent vegetation)	>3 species
	91	Interspersion between vegetation classes is low (see Fig. 3)	
	92	Vegetation interspersion is moderate	
	93	Vegetation interspersion is high	
	94	Average width of wetland vegetation is >20 feet	

BUFFERS

	95	Wetland has a forested or scrub-shrub buffer wider than 150', along >50% of its circumference
	96	Buffer is forest or scrub-shrub, 20'-150' wide along >50% of circumference
	97	Buffer is forest or scrub-shrub wider than 150', along 25%-50% of circumference
	98	Buffer is forest or scrub-shrub 20'-150' wide along 25%-50% of circumference
	99	Buffer is impervious at wetland edge along >50% of circumference
	100	Buffer is croplands along >50% of circumference
	101	Buffer is pasture along >50% of circumference
	102	Buffer is commercial/industrial along >50%of circumference
	103	Wetland has a dense understory edge along its upland boundary for >25% of circumference
	104	There is a vegetation buffer of any kind along a stream or channel wider than 100' for >50% of distance either side
	105	Vegetation buffer along a stream or channel wider than 100' for 25%-50% of distance either side

LANDSCAPE

	106	Wetland has a seasonal or permanent water connection to another wetland within 200 yds.
	107	Wetland has a year-round, permanently flowing, stream
	108	Stream or channel in wetland has fish
	109	Wetland is a fringe along a dead end slough
	110	Wetland is a fringe on a river
	111	Wetland is connected to upland natural areas by an uninterrupted herbaceous corridor >20' wide
	112	Wetland is connected to upland natural areas by an unbroken forest or scrub-shrub corridor >20' wide
	113	Wetland has a permanent unobstructed (no tide-gate) water connection to a river or slough

SPECIAL HABITAT FEATURES

	114	Wetland has plant species that are preferred food of waterfowl
	115	There is evidence of beaver dams in the wetland
	116	Wetland has woody debris in areas of open water
	117	Wetland has woody debris above water
	118	Wetland has eroding banks suitable for nesting
	119	Wetland has raptor perches

DISTURBANCES

	120	Wetland may trap inorganic sediments generated in its watershed
	121	Does the wetland act as significant trap for sediment in the watershed?
	~~122~~	~~Wetland shows evidence of impacts from excess sediments (record evidence in field notes)~~
	123	Wetland shows evidence of net erosion (record evidence in field notes)
	124	Wetland shows evidence of impacts from excess nutrients (record evidence in field notes)
	125	Wetland shows evidence of impacts from stormwater discharges (record evidence in field notes)
	126	There is evidence of impacts from toxics (record evidence in field notes)
	127	The primary source of toxics to the wetland is from sheetflow coming in along upland edges or groundwater
	128	More than 20% of watershed above the wetland is impervious
	129	Wetland is used for grazing
	130	Wetland is cultivated (either for crops, forage or hay)

	131	Wetland has been ditched for drainage
	132	Wetland has vertical bulkheads present >50% of one shore or edge
	133	Wetland has vertical bulkheads present on 10%-50% of one shore or edge

Appendix C

IVA Data Set and Frequency Distributions of IVA Data

Available In the
City of Everett
Planning Department
2930 Wetmore Ave.
Everett, WA 98201

Appendix I

GIS Mapping Methodology

GIS Mapping Methodology

Geographic Information System (GIS) technology provided valuable tools for mapping data and assessing spatial and statistical relationships in the SEWIP study area. Mapping for the SEWIP project utilized data from Everett's existing GIS database, scanned aerial photographs, state agency GIS data, and field work. This appendix provides a summary of the GIS mapping methodology used to produce the maps in this report. The appendix is divided into four sections: Data Sources, Methodology, Hardware/Software and Data Dictionary.

Data Sources:

- Army Corps of Engineers (Seattle, WA) Color Infrared Aerial Photo Series. (9" x 9" contact prints, Scale: 1:24000, Photo Date: August 18, 1993).
- Army Corps of Engineers (Seattle, WA) working maps for Department of Housing and Urban Development, based on 1973 data. Scale: 1:4800.
- City of Everett, GIS Database. Based on 1991 and 1993 aerial photography (scale: 1:7200), utility charts and field work. Global Positioning System (GPS) controlled with a horizontal spatial accuracy of approximately 2 feet. Primary data layers used for SEWIP project: Hydrology, Transportation, and Buildings.
- State of Washington, Department of Natural Resources, Soil Conservation Service, Soil Polygon Township GIS database.
- State of Washington, Department of Fish and Wildlife, Priority Habitat and Species (PHS) GIS database. Based on 1:24000 scale data.

Methodology:

1. Scan 9" x 9" Color Infrared Contact Prints on Hewlett Packard ScanJet II color scanner. Photographs were scanned at a resolution of 500 lines per inch. Hewlett Packard's Deskscan program was used to create Tagged Image File Format (TIFF) files. Six photos were scanned, each creating a 60 megabyte TIFF file.
2. Used Arc-Info GRID software to assign real-world coordinates to TIFF images. The software "rubber-sheets" the image to fit Everett's existing high accuracy GIS database. The Arc-Info commands used to integrate the images into the GIS database were "register", "rectify" and "controlpoints".
3. Divided the 60 megabyte TIFF image files into quarter images. This greatly reduced computer processing time as the resulting images were approximately 15 megabytes in size. The total number of images was now 24 (6 prints x 4 quarters). The images were quartered using the Arc-Info "rectify" command.
4. Plotted TIFF images on Calcomp color electrostatic plotter. Images were plotted at 1" = 600'. This resulted in color infrared plots measuring about 15 inches square.
5. Color image plots were used by the technical committee in the field as a basemap for mapping wetland complex boundaries and assigning complex record numbers. This information was directly applied to the plots in the field using pencil or pen.
6. The marked up field plots were taped to a Calcomp Drawing Board II digitizing tablet. Registration points were added at the corners of each image. The Arc-Info Arcedit

module was used to digitize the fieldwork lines on the plots. This resulted in the creation of a digital line file for each field map.

7. The digital line files were transformed from digitizer units (inches) to map units (state plane feet) by assigning real world coordinates to the registration points at the image corners. As a result of this operation all of the digital line files representing wetland complex boundaries could be displayed on the computer as they related geographically to Everett's existing GIS database layers.
8. The individual digital line files were "edge matched" or "stitched" together using the Arc-Info command "append". This produced a seamless coverage of wetland complexes covering the entire estuary.
9. Arc-Info Arcedit editing environment was used to clean the digital linework in the estuary-wide file. This editing ensured that wetland complex boundaries formed complete polygons and also assigned a data point to each complex.
10. The INFO relational database environment was used to assign attribute data to the individual wetland complex polygons. This data was imported in ascii format from a Lotus 123 spreadsheet and from Microsoft Word text files.

Hardware/Software:

Hardware:

- Sun Microsystems SPARC 20-61 UNIX Workstation, 4 Gigabytes of storage, 64 Megabytes of RAM, Solaris 2.4 UNIX operating system.
- Calcomp Drawing Board II 24" x 36" digitizing tablet.
- Calcomp 68000 series 36" wide color electrostatic plotter.
- Hewlett Packard Deskjet 1200C Color Printer
- Hewlett Packard Laserjet 4V Laser Printer
- Hewlett Packard ScanJet II Color Scanner

Software:

- Environmental Systems Research Institute (ESRI) Arc-Info Geographic Information System software with GRID raster processing module.
- Sun Microsystems Solaris 2.4 UNIX operating system.
- Microsoft Windows 3.1
- Microsoft Word for Windows 2.0 & 6.0
- Microsoft Excel 4.0 for Windows
- Lotus 1-2-3 Release 3

Data Dictionary:

The following list of fields represents an actual wetland complex record for complex number 340. Every wetland complex in the database contains an attribute record in this format.

AREA	=	746,947.52484	*required by system (square feet)*
PERIMETER	=	3,982.47300	*required by system (feet)*
SWISWET#	=	100	*required by system (internal ID number)*
SWISWET-ID	=	80	*required by system (internal ID number)*
COMPNUM	=	340.0	*wetland complex record number*
ACRES	=	17.15	*derived from area*
TYPE	=	VG	*vegetated (VG) or mud flat (MF)*
LANDUSE	=	S	*urban (U), conservation (C) or sensitive resource constraints (S)*
VEGCOV1	=	EMERGE	*primary vegetation cover*
VEGCOV2	=		*secondary vegetation cover*
AGR	=	Y	*agricultural land (Y or N)*
WNAMES	=	None	*observed wildlife names*
WNOTES	=	None	*wildlife observation notes*
WLD#	=	11	*wildlife score (from IVA model)*
WQ#	=	47	*water quality improvement score (IVA)*
SSAV#=	50		*aesthetic value (IVA)*
SSTR#	=	9	*transportation access (IVA)*
SSTR2#	=	5	*transportation with habitat value overlay*
SSRE#	=	47	*recreation score (IVA)*
WLDRNK	=	2	*wildlife rank (from WLD#)*
WQRNK	=	1	*water quality rank (from WQ#)*
SSAVRNK	=	1	*aesthetic value rank (from SSAV#)*
SSTRRNK	=	3	*transportation rank (from sstr#)*
SSTR2RNK	=	3	*trans. w/hab. overlay (from sstr2#)*
SSRERNK	=	2	*recreation rank (from sstr2#)*
WWPRK	=	1	*wildlife/water qual perf. rank*
MGATE	=	52.0	*mitigation map shade symbol*
JURIS	=	MV	*jurisdiction*
PUBLIC	=	N	*public land (Y or N)*

Appendix J

List of Assumptions for Applying IVA Model in Field

Manual for Use and Application of Snohomish Estuary Indicator Value Assessment

Introduction

The Indicator Value Assessment Model (IVA) was specifically developed for the Snohomish Estuary over a five-month period in 1994 by a team of wetland scientists from the EPA, Corps of Engineers, Washington Department of Ecology, Washington Department of Fisheries and Wildlife, Snohomish County (Surface Water Management and Planning), City of Everett (Planning and Public Works), Sheldon and Associates, and Pentec Inc.

The completed Habitat Evaluation model consists of a 132 habitat questions and 41 Social Attribute questions. The habitat questions are divided into the areas of: Water Regime; Physical Features, Buffers; Landscape; Special Habitat Features, and Disturbances.

This document sets forth the mapping methodology and assumptions used in applying the IVA model in the field.

Mapping Methodology

Wetland complexes were base-mapped on color-infrared aerial photos (8/18/93), scale 1:600) according to common hydrological boundaries. Black and white aerial photos (2/24/91 scale 1:600) were also used to map units. Hydrological boundaries consisted individually of or a combination of : sloughs, streams, channels, ditches, dikes and roads. Ditches were considered as a part of the unit they bounded. Small sloughs were also considered part of the adjacent units. Edge units, outside of the dikes on major sloughs and the main river, were mapped separately.

When a distinct change in the plant community was present and represented an area greater than one acre, sub-units were inventoried separately, but were recombined within the hydrological boundaries for the purposes of the evaluation and mapping. Unit boundary information was digitized for mapping purposes using Geographic Information System (GIS) software.

Wetland delineations were not done for the purposes of this planning-level study. The implied assumption in mapping and evaluating the wetland units is that most of the estuary historically was wetland and would return to wetland if it were not diked and drained. The evaluation process is used to differentiate between the agricultural fields and relatively pristine wetlands that remain in the estuary. However, when it was clear that hydrology, wetland soils, and indicator plants, were all absent on a site, it was mapped as upland.

Inventory Methodology

Low elevation, 35 mm color oblique aerial photos were taken of the estuary during a flight on May 3, 1994. These photos were used in identifying the units on the ground and as indicators of the extent of seasonal flooding. Each unit was visited in the field and photographed on the ground (35mm Fujichrome slides and 35mm Kodacolor prints). Vegetation, land use, and

wildlife observations were made and recorded on a data sheet. Percentages of vegetation species cover within each cover type were estimated to the nearest 5 percent. Representative wetland indicator species were identified with the used of field guides and vegetation keys. (See references for the list of Plant Species Observed) Soil samples were taken in some areas with an auger to resolve questions on saturation levels. Wildlife specimens were collected if found dead but in good condition and taken to the Burke Museum for identification. Live wildlife were identified with field guides.

Evaluation Methodology

All wetland complexes were individually evaluated with using the IVA Field Questions. Units were generally evaluated by teams of two field staff, after initially visiting and evaluating several units in a larger team to try out the model. Information collected in the inventory was used in applying the IVA questions. Notable site conditions and any problems in answering any questions were recorded in the margins for later reference and resolution. When the field work was completed, data collected were subjected to rigorous quality control checks before and after entry into the model spreadsheet and GIS software.

IVA Assumptions

The following represents the list of assumptions used by the field teams in applying the Snohomish Estuary Indicator Value Assessment habitat evaluation model. The number listed for each assumption corresponds to the Indicator Question number in the attached Field Questions. Questions needing no further explanation to be applied in the field are not included in this list.

In some cases, questions about the specific application of the IVA question are presented.

Field Question #) Assumption

1-3) The dominant hydrological regime is selected. However, if there are more than one source of hydrology which play a significant role in the wetland complex then they are all selected. For example, the Simpson Lee wetlands receive year round flow from Bigelow Creek but are also subject to tidal influence; both sources of hydrology, therefore, were selected for this wetland.

4) If a dike separates a unit from tidal action or flooding, it is considered to be effectively above MHHW (11 feet), and the question would be answered no. This applies even though a diked wetland complex may be physically below MHHW. However, when evaluating the potential functional value of units if tidal influence were restored, the answer to this question would have to be changed to reflect the actual tidal elevation.

6) Ditches have only slow velocities except for ditched streams from upland, which may have a range of velocities. Wetlands without streams, channels or ditches should also be answered yes for slow velocities. (See question 7)

7) A range of velocities may apply to a system either spatially (such as variations in velocity caused by meanders and debris in naturally flowing streams) or temporally (variations in velocity between summer and winter flows). Therefore, diked streams would have a range of

velocities, especially where they initially enter the flat lands from the uplands. Tidal wetlands also have a range of velocities.

8) a) Diked units that are not located on either of the mainland sides of the estuary have no natural inlet, because the slough channels that were the main source of hydrology are now blocked by dikes. If inlet is a culvert that allows tidal inundation only at higher tides, then answer “no”.

b) A permanent culvert without tidegate that allows tidal inundation is considered a permanent, unobstructed, natural inlet (answer yes) with the following exceptions: the culvert is filled with debris, the culvert restricts tidal inundation to higher tides (answer no). If the wetland is surrounded by a dike that is broken in one or more locations, it is considered to have a natural inlet.

c) A culverted stream is considered a natural inlet, unless the culvert is filled with debris.

d) The answer should be yes for natural inlet for wetlands on east and west mainland sides that are influenced by stream inputs. This applies even if the stream is ditched and does not appear to influence the larger portion of the complex. In most cases, the streams on the east and west side will flood the larger complexes during the winter months.

10) Tidegates are considered permanent outlets.

11, 12) It is assumed that a restriction is a significant physical impediment within the channel, ditch or stream, such as a log jam, beaver dam, or tide gate. A culvert is not an obstruction for a tidal wetland, but may be a restriction. Narrow channels or occasional breaks in dike are not considered restrictions.

14) "Overbank" can refer to either stream flooding (for wetlands at the edge of the study area) or tidal flooding. .

15) "Dendritic" can mean a classic salt marsh with first, second, and third order channels, or wetlands a high frequency of at least second order channels throughout.

16) Ditches are considered to be channels. Even though they were constructed for drainage, most ditches in the estuary provide waterfowl habitat for loafing and feeding as well as corridors for small mammals. Some ditches also provide fish habitat. Even ditches that dry up seasonally provide some wildlife benefits during winter months, as well as transporting nutrients to and from the wetland units. and/or fish.

Streams, channels or ditches that border a wetland are considered part of the unit, except that tidal sloughs or channels are not considered as part of an adjacent, diked palustrine wetland. These tidal sloughs and riparian areas are evaluated and ranked as separate units.

18, 19) Assumes that flooding is not based on daily tidal flooding, but based on U. S. Army Corps of Engineers flood frequency analysis, as follows:

Unit outside the dike and non-tidal floods once a year;
Unit outside the dike and tidal floods every 1 to 5 years;
Unit inside the dike floods every 1 to 5 years, even if the tidegate is broken.

21-30)Use conventional growing season (3/1 to 12/1) period for determining the hydroperiod present.

Reason - Because the estuary is completely flooded during the winter all wetlands in the estuary would be considered seasonally flooded at a minimum. This tends to give the model no ability to distinguish between other hydroperiods that dominate during other portions of the year. Further, the farmers begin to pump and drain their lands in March, which affects the biology of evaluated wetlands. We feel it is important to capture this pumping effect on the wetland ecology. We have also based our hydroperiod estimations on baseline air photos flown in May 3rd of this 1994.

Use the following definitions for the different water regimes found in the Estuary.:

Water Regime	**Description of Water Regime**
Temporarily Flooded	Floods most years for less than two weeks during the growing season; usually dry by mid-growing season.
Saturated	Substrate is saturated for most of growing season (commonly year round) and rarely floods
Seasonally Flooded	Floods most years for two weeks or more during growing season, usually dry by end of growing season.
Intermittently Flooded	Nearly permanently flooded, exposed only during drought conditions.
Permanently Flooded	Remains flooded throughout the year in all years

Examples:

If air photos show no areas of ponding, and the unit is an agricultural field with little relief then "temporarily flooded" should be assigned.

If air photos show significant areas of ponding and the agricultural field has moderate variation in topography then "seasonally flooded" should be assigned.

If air photos show significant areas of ponding and field observation demonstrates that ponding is of significant depth and groundwater/stream fed, (24"+) then "permanently flooded" should be assigned.

Wettest Hydroperiod - Ditches with year-round water are typically assigned "permanently flooded."

31, 32) "Estuarine" here includes tidal wetlands within the "saline" and "brackish" ecological units, as defined in the Pentec landscape analysis. Freshwater tidal units are those within the upstream fluvial freshwater area of the estuary.

38-42) Seasonal open water percentages are based on a comparison of open water present during the summer field visit and the May 3, 1994 oblique aerial photos. *Seasonal open water*

should not include permanent open water. All tidally influenced wetland complexes should have no seasonal water entries.

43-45) This series of questions should be applied to both seasonal and permanent open water areas as viewed on air photos and in the field. This did not include areas where they where the wettest hydroperiod is temporarily flooded. This may include areas of emergent vegetation because emergent species would not appear until later in the growing season. This will also occur within grazed or cultivated fields. However, for areas of undisturbed *Phalaris arundinacea* where dieback does not typically occur , open water should not be indicated even though it might be present if the field were grazed. Straight-sided ditches, with no gradual edge, were assumed to be only 36-60 inches (#44).

46-49) Must be based on field examination. Use the presence of Typha sp. to indicate the presence of water depths from 24 inches to 60 inches.

51-53, 55, 56) Must be based on permanent open water only, not seasonal.

53) Tidal wetlands with side channels are considered mosaic.

54) Irregular upland edge applies only to upland and not the edge between different vegetation classes within the same hydrological unit. Upland consists of scrub/shrub or forested dikes or road berms, etc., a minimum of 20 feet wide, or natural upland area on east and west edges of the study area. Irregular fill areas on a wetland unit are not considered to constitute an irregular upland edge. See question 63-89 for further discussion of upland edge.

55,56) Applies to ditches that are sheltered by overhanging vegetation or are narrow and deep enough to be protected from winds and waves. Vegetated areas protected by trees and shrubs tall enough to provide a wind break are also included in question 55. If a salt marsh is associated with a large mudflat (>300 feet wide) then it is considered protected from waves.

57-58) Include *Phalaris arundinacea* (reed canary grass) and other tall emergent species as overhanging vegetation in narrow ditches.

59-61) These answers are based on Soil Conservation Service maps. Xerothent and Urban land are considered "sand". Also, if fill is present on a substantial portion of the unit and consists of sands, rubble, concrete, etc., answer “yes” to “sand”. Puget and Snohomish silty or silty-clay loams are considered "mud". Mukilteo muck and terric medisaprists are considered "organic".

63-89) Vegetation classes: If a vegetation class has less than 50% coverage of wetland indicator species (FAC or wetter), it should not be counted as a class in these questions. In addition, if the class is distinctly separated physically and consists of non-wetland species, it should be considered an upland. Non-wetland species within a wetland class should not be counted towards the number of species for this section of wetland questions. Wetland species must have at least 5% coverage to be counted within a class. (Species with less than 5% aerial coverage were considered a 'trace'.)

63-68) For dominant forest class, species may be present in both the 20'-50' range, and the greater than 50' range. They are not mutually exclusive. Tree height was not measured with a

clinometer. Canopy cedars, cottonwoods and sometimes alders were assumed to be greater than 50' tall; all other tree and tall shrub species were assumed to be in the 20'-50' range.

91-93) There must be more than one vegetation class to answer yes for any of the interspersion questions.

95-102) For the purposes of these questions, buffer refers to anything adjacent and external to the outside edge of a wetland complex. Questions 95-99 are mutually exclusive, but otherwise all questions that apply should be answered yes.

95) If one side of unit is open water for greater than 100 feet, then use 25% of circumference.

96-98) Use 50% of circumference if one side of the unit is greater than 100 ft. open water.

99) Only hard surfaced features should be considered to be impervious, including asphalt, concrete roads and parking lots. Gravel roads, dikes and railroad beds are not considered impervious. Only applied if immediately adjacent.

100-101) This question could apply if the use is separated by dike or ditch, but a wide body of water such as a slough channel is considered a buffer, and therefore any cropland or pasture beyond the slough channel is not adjacent. If crop and pasture together, but not individually, make up more than 50% of the buffer, then select the dominant agricultural use.

106) This question applies to all ditches that connect wetland units within 200 yards. For an explanation , see question 16.

107) For this question to apply, the wetland has to be on the east or west side of estuary (mainland) and clearly be a flowing stream.

110) Answer yes only if the wetland is on a river, not separated by dikes. This question should <u>not</u> be answered yes for a wetland that has a substantial dike surrounding it, even if the dike is broken in places providing a tidal connection.

111-112) Two lane roads, barbed wire fences, grazed/cultivated fields and scattered development are not considered to be breaks in the corridor.

113) The connection must be unobstructed, without a intervening structure such as a unbroken dike, tide gate, road or berm.

114-119) Answer yes for any of these questions if at least one of the special habitat features was present.

114) Only food for waterfowl was addressed because of waterfowl prominence in the estuary.

116) In tidal marshes, debris is left in higher portions of the marsh, not inundated daily.

118) Eroding banks, apply to nesting passerine birds, such as swallows, and aquatic mammals, such as beavers. We assumed no nesting would occur on tidal eroding slopes because of daily inundation up to the vegetated tops of the banks. Eroding banks for nesting

may occur in ditches that have *Phalaris arundinacea*, which may be used for nesting by mallards.

120) This question should be read as follows: "Does the wetland act as a significant trap for sediment in the watershed." For mainland wetlands that have streams, trapped sediment comes from upland subdivisions. This should also be answered yes for diked wetlands where the tidegate is not working, and therefore sediment is being trapped. Also answer yes when the wetland receives sediment from relatively large outside sources, such as the dredge disposal site next to Langus Park or from major roads where the unit's edge to area ratio is high.

122) This question is being dropped because of confusion in interpretation, and because most of the water quality impacts from sediments were from agricultural activities such as grazing and cultivation, which are already accounted for in the grazing and cultivation questions.]

124) The presence of algae blooms is used to indicate excess nutrients. Also, recent Department of Ecology water quality data was used.

126) Use the presence of known toxic contamination (Tulalip Land Fill), evidence of herbicide use, or the presence of unknown discharges into wetland (e.g. dead wetland vegetation around discharge present)

128) Apply only to diked nontidal wetlands.

2/97

Appendix K

List of Plant Species Observed

Plant Species Observed

The wetland indicator status for each species is from the U.S. Army Corps of Engineers Region 9 indicator list (1994). Where the plant is only identified by genus, the least wet indicator status is shown. Scientific names are from Hitchcock, 1991, as updated in Cooke, 1995. Recently changed scientific names are presented as follows: new name = old name. Common names are from a variety of sources listed in the references at the end of the plant list.

Scientific Name	Indicator Status	Common Name
Acer macrophyllum	FACU	Big-leaf maple
Achillea millefolium		Yarrow
Agropyron spp.		Wheatgrass or quackgrass
Agrostis spp.	FAC	Bentgrass
Alisma plantago-aquatica	OBL	Broadleaf water plantain
Alnus rubra	FAC	Red alder
Alopecrurus spp.	FACW	Foxtail
Ammophila arenaria	FACU	European beach grass
Anthemis cotula		Stinking cammomile
Arrhenatherum elatius		Oat grass
Aster subspicatus	FACW	Douglas aster
Athyrium filix-femina	FAC	Ladyfern
Atriplex patula	FACW	Saltbrush, fat hen
Berberis aquifolium		Tall Oregon grape
Betula papyrifera		White birch
Bidens cernua	FACW+	Nodding beggarticks
Brassica spp.		Field mustard
Bromus spp.		Brome
Callitriche heterophylla	OBL	Water starwort, larger water starwort
Capsella bursa-pastoris		Shepard's purse
Carex deweyana	FACU	Dewey sedge
Carex lyngbyei	OBL	Lyngbye's sedge
Chenopodium album		Lamb's quarters
Chrysanthemum leucanthemum		Oxeye daisy
Cirsium arvense	FACU+	Canada thistle
Cirsium vulgare		Bull thistle
Conium maculatum	FAC+	Poison-hemlock
Convolvulus sepium		Hedge bindweed
Cornus sericea = C. stolonifera	FAC	Red-osier dogwood, red-stem dogwood
Cotula coronopifolia	FACW+	Brass buttons
Crataegus monogyna		Red hawthorn or common hawthorn
Crepis spp.		Hawksbeard
Cytisus scoparius		Scot's broom
Dactylis glomerata	FACU	Orchard grass

Scientific Name	Indicator Status	Common Name
Deschampsia caespitosa	FACW	Tufted hairgrass
Carex obnupta	OBL	Slough sedge
Cerastium spp.		Chickweed
Daucus carota		Queen Anne's lace
Dipsacus sylvestris		Teasel
Distichlis spicata	FAC+	Saltgrass
Echinocloa crusgalli	FACW	Barnyard grass
Eleocharis spp.	OBL	Spikerush
Enteromorpha spp.		Green algae
Epilobium angustifolium		Fireweed
Epilobium ciliatum = C. watsonii	FACW-	Marsh willow-herb or willlow-weed
Equisetum spp.	FAC	Horesetail
Filagniella uliginosum	FAC+	Marsh cudweed
Fucus spp.		Brown algae
Galium spp.		Bedstraw
Gaultheria shallon	FACU	Salal
Geum macrophyllum	FACW-	Largeleaf avens
Glyceria spp.	FACW+	Mannagrass
Grindelia integrifolia	FACW	Puget Sound gum weed
Heracleum lanatum	FAC	Cow parsnip
Holcus lanatus	FAC	Common velvetgrass
Holodiscus discolor		Oceanspray
Hordeum brachyan therum	FACW	Meadow barley
Hordeum spp.		Barley
Hypochaeris radicata		Hairy cat's ear
Impatiens noli-tangere	FACW	Yellow touch-me-not, jewel weed
Iris pseudacorus	OBL	Yellow iris
Jaumea cornosa	OBL	Fleshy jaumea
Juncus bufonius	FACW	Toad rush
Juncus effusus	FACW	Soft rush
Juncus ensifolius	FACW	Dagger-leaf rush
Lemna minor	OBL	Small duckweed
Lilaea scilloides	FACW	Flowering quillwort
Lilaeopsis occidentalis	OBL	Western lilaeopsis
Lolium perenne	FACU	Perennial ryegrass
Lonicera involucrata	FAC+	Black twinberry
Lotus corniculatus	FAC	Bird's-foot trefoil
Lysichiton americanum	OBL	Skunk cabbage
Lythrum salicaria	FACW+	Purple loosestrife
Malus fusca = Pyrus fusca	FACW	Crabapple
Matricaria matricariodes		Pineapple weed
Medicago lupulina		Black medic
Melilotis alba		White sweet clover
Mentha arvensis	FACW-	Field mint
Mimulus guttatus	OBL	Common moneyflower
Myosotis laxa	OBL	Small water forget-me-not
Myriophyllum spicatum	OBL	Eurasian water-milfoil
Nasturtium officinale = Rorippa nasturtium-aquaticum	OBL	True water-cress

Scientific Name	Indicator Status	Common Name
Nuphar luteum	OBL	Yellow pondlily
Oemleria cerasiformis	FACU	Indian plum, osoberry
Oenanthe sarmentosa	OBL	Water parsley
Parentucellia viscosa	FAC-	Yellow parentucellia
Phalaris arundinacea	FACW	Reed canary grass
Phleum pratense	FAC-	Timothy
Phragmites australis = P. commuis	FACW+	Common reed, reedgrass
Physocarpus capitatus	FACW-	Pacific ninebark
Picea sitchensis	FAC	Sitka spruce
Pinus contorta	FAC	Lodgepole pine
Plantago Lanceolata	FAC	English or rib plantain
Plantago major	FACU+	Broadleaf plaintain
Plantago maritima	FACW+	Seaside plantain
Poa spp.		bluegrass
Polygonum euspidatum	FACU	Japanese knotweed, false bamboo
Polygonum persicaria	FACW	Ladysthumb
Polygonum hydropiper	OBL	Waterpepper
Polygonum hydropiperoides	OBL	Mild waterpiper
Polygonum punctatum	OBL	Dotted smartweed
Polypodium glycyrrhiza		Licorice fern
Polystichum munitum	FACU	Swordfern
Populus balsamifera trichocarpa	FAC	Black cottonwood
Potentilla anserina ssp. pacifica	OBL	Pacific silverweed
Potentilla spp.	OBL	Cinquefoil
Potamogeton spp.	OBL	Pondweed
Prunus emarginata	FACU	Bitter cherry
Ranunculus repens	FACW	Creeping buttercup
Rhamnus purshiana	FAC-	Cascara, buckthorn
Rosa nutkana	FAC	Nootka rose
Rubus laciniatus	FACU+	Evergreen blackberry
Rubus parviflorus	FAC-	Thimbleberry
Rubus procerus = R. discolor	FACU	Himalayan blackberry
Rubus spectabilis	FAC+	Salmonberry
Rumex acetosella	FACU+	Sheep sorrel
Rumex crispus	FAC+	Curly dock
Rumex spp.	FAC	Dock
Sagittaria latifolia	OBL	Duck potato, wapato, arrowhead
Salicornia virginica	OBL	Pickleweed
Salix lucidavar lasiandra = s. lasiandra	FACW+	Pacific willow
Salix scouleriana	FAC	
Salixpiperi	FACW	Piper willow
Salix spp.	FAC	Willow
Sambucus racemosa	FACU	Red elderberry
Scirpus acutus	OBL	Hard-stem bulrush
Scirpus americanus	OBL	Three square bulrush
Scirpus maritimus	OBL	Seacoast bulrush
Scirpus tabernaemontanii =	OBL	Softstem bullrush

Scientific Name	Indicator Status	Common Name
s. validus		
Scirpus microcarpus	OBL	Small-fruited bulrush
Senecio jacobaea		Tansy ragwort
Sidalcea sp.		Checker-mallow
Solanum dulcamara	FAC+	Bittersweet nightshade
Sorbus scopulina	FACU	Green's mountain ash
Solidago canadensis	FACU	Canada goldenrod
Sparganium spp.	OBL	Burreed
Sphagnum spp.		Peat moss
Spiraea douglasii	FACW	Douglas spirea
Symphoricarpos albus	FACU	Common snowberry
Tanacetum vulgare		Tansy
Taraxacum officinale		Common dandelion
Tellima grandiflora		Fringecup
Thuja plicata	FAC	Western red cedar
Tolmiea menziesii	FAC	Piggyback plant
Trifolium repens	FAC	White clover
Trifolium pratense	FACU	Red clover
Triglochin maritimum	OBL	Seaside arrow grass
Tsuga heterophylla	FACU-	Western hemlock
Typha angustifolia	OBL	Narrowleaf cattail
Typha latifolia	OBL	Common cattail
Ulva spp.		Sea lettuce
Urtica dioica	FAC+	Stinging nettle
Utricularia spp.	OBL	Bladderwort
Vaccinium spp.		Blueberry or huckleberry
Veronica americana	OBL	American breaklime
Veronica anagallis-aquatilis	OBL	Water veronica
Veronica scutellata	OBL	Marsh veronica
Vulpia spp. = Festuca spp.		Fescue
Zostera japonica	OBL	Dwarf eelgrass
Zostera marina	OBL	Eelgrass

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Kozloff, E. 1976. Plants and Animals of the Pacific Northwest. University of Washington Press. Seattle, Washington.

Pojar, J. and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia & Alaska. Lone Pine Publishing, Vancouver, British Columbia, Canada.

Scientific Name	Indicator Status	Common Name

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Appendix M

Appendix to Management Plan (Chapter 5):

Recommendations for Implementation of SEWIP Including Non-Regulatory Guidance

Recommendations for Implementation of SEWIP Including Non-Regulatory Guidance

5A.2.1 Specific Management Recommendations Based on Ecological Management Units

The following general land use management recommendations are based on input from the SETAC and User Committee. Letters of comment submitted by Committee members are included in Appendix D, available as a separate document. The recommendations seek to establish a framework for recreational uses in the Estuary (see section 5A.5.1). The recommendations are first presented for each Ecological Management Unit (see Figure 2.2) and then specifically for each type or category of Restoration/Enhancement.

Ecological Management Unit 1.0

Management Objectives: Agriculture. Existing agriculture would be protected and encouraged. Dikes and ditches would be maintained including repair and/or replacement of damaged and broken dikes. Additionally, restoration and enhancement for areas identified in Tables 5.3 and 5.4 would be permitted. Expansion of the Everett Wastewater Treatment Plant would be permitted in the southern portion of the unit adjacent to the existing wastewater ponds for necessary municipal services in the future. If mitigation is provided consistent with all applicable local, state and federal requirements, dikes and ditches protecting the wastewater treatment facility may be maintained to COE standards for dikes protecting critical facilities. Recreation would be limited to passive uses within the slough channels including fishing, wildlife observation, canoeing and kayaking. Hunting (consistent with local ordinance - not permitted in County parks), hiking and wildlife observation would be controlled by property owners on a permission-only basis. Power boats would be permitted, but speed and noise would be limited to a level where wakes would not be created, wildlife would not be disturbed and public safety would not be endangered. Motorized recreational craft, including jet skies, would be encouraged to restrict their use to the main channel of the Snohomish River.

Primary Habitat Type: Palustrine emergent seasonally flooded, with sub-areas of palustrine forested and scrub-shrub habitat.

Habitat Protection Goals: Protect existing riparian corridors along river channels and sloughs and areas of forested and scrub-shrub plant communities as feeding, breeding and refuge habitat for large and small mammals, nesting, resting, feeding and refuge habitat for bird species including passerine birds and some waterfowl such as wood duck, and resting and nesting habitat for raptors such as the red-tailed hawk. This would include forested areas within Marshland, the Fish and Wildlife property on South Ebey and privately owned forested areas on South Ebey, and publicly owned areas such as Otter Island, South Spencer, Nyman Farm, east mainland in far northern portion of unit, and forested edges of East Smith Island. Protect

existing Special Habitat Attributes areas with non-regulatory incentive programs[1]. This would include protection of waterfowl resting and feeding areas during the winter months within agricultural fields.

Restoration/Enhancement Goal: Use non-regulatory programs to encourage enhancement and restoration of existing agricultural lands for waterfowl and shorebird use. For properties owned by Snohomish County Parks (or any other public resource entity) on the north end of South Ebey Island (Restoration sites 3 and 4), restoration to tidal marsh consistent with Table 5-3 should be undertaken. All restoration and enhancement projects should be sited and designed to not conflict with existing adjacent agricultural activities and to be:

- consistent with the provisions of the adopted Shoreline Master Program for the area and this Management Plan; and
- coordinated with the implementation of Diking District Policies.

Non-regulatory enhancement measures could consist of: enhancing ditches, old sloughs and edges of fields within agricultural areas to create habitat corridors between larger forested and emergent/scrub-shrub habitat. Enhancement could include widening of ditches to create shallow emergent zone (plant species for waterfowl are one possibility) and sloping of sides to create scrub-shrub zone and to facilitate animal migration. Forested and scrub-shrub habitat could also be established along old slough and channelized stream channels.

Other non-regulatory habitat enhancement measures to be considered include: side-channel (agricultural ditches) pond development; planting fallow fields with wildlife food crops after cash crops are harvested; flooding fields during the winter to provide waterbird habitat for migrating waterfowl; leaving and/or developing hedgerows, brush piles, snags; curtailing agricultural activity during breeding season in documented nesting areas; using both the Integrated Pest Management practices and the Natural Resources Conservation Service's "Best Management Practices" such as not plowing to field's edge.

These non-regulatory measures could be implemented through a cooperative program with a farmer/community organization, such as Snohomish County Land Trust or Natural Resources Conservation Service, to benefit waterfowl and/or other important species groups. Examples include the existing cooperative program in the Skagit Valley for sustainable agriculture (WDFW, WSU Cooperative Extension) and the American Farmland Trust.

Additional non-regulatory measures could include the placement of wetter and less productive fields into the USDA's Wetland Reserve Program. In this program landowners are paid up to the fair market agricultural value for permanent easements on lands enrolled where wetlands are restored. Restoration activities can include plugging or pulling tiles, plugging some ditches and revegetation of enrolled wetland and riparian areas. Cost of restoration measures is shared.

The following areas for potential non-regulatory corridor enhancement are identified for guidance purposes only and are not specific recommendations to be imposed upon farmers.

[1] Please see Guidebook for Wetland Stewardship produced by the Department of Ecology for non-regulatory approaches to wetland protection and restoration (Contact Jane Rubey).

Non-regulatory Area 1 - North Portion of South
Ebey Island, north of Highway 2 (east edge of both WC 107, 108)

Non-regulatory Area 2 - South Portion of South
Ebey Island, directly South of Highway 2 (north edge of WC 57 and 58, west edge of 64 and 65, middle portion of 71, north edge of 78, north and east and south edges of 81, east and west edges of 84, north edge of 97).

Non-regulatory Area 3 - East Mainland (west and south edge of WC 124), (west edge of: 178, 211, 215, 217, 218, 219, 220), (south and west edge of 221), (west edge of: 222, 223, 224) (west and south edge of 225), (west edge of 229, 326) (southwest edge of 327) (south edge of 337), (north edge of 338). This area contains numerous ditched streams which flow from upland areas into the Estuary. Some of the streams (WC 124) have excellent water quality and fish present. Restoration of habitat corridors along these channelized streams will greatly improve the habitat value and movement of animals and birds between the Estuary and the forested upland areas. In addition, these corridors run along the dike edge and connect high value wetlands such as 227 to the south and 139 to the north.

Non-regulatory Area 4 - Marshland (east edges of WC 195, 197, south edge of 209, east edge of 322, east edge of 324 and southeast and east edge of 325, south edge of 329, north edge of 330). This area also contains numerous streams which flow from a heavily wooded corridor into the Estuary. Restoration of habitat corridors along these channelized streams will greatly improve the habitat value and movement of animals and birds between the Estuary and upland areas particularly along the Wood Creek riparian corridor in the southern portion of the study area (WC 324, 325, 330).

Recreation Goal: Encourage diking district to permit kayak and canoe boat launches and landings on a "pay as-you-go" basis. Establish programs where organized recreation and hunting groups lease land from farmers and diking district for wildlife observation and hunting. This could include programs which allow limited hiking along the top of dikes in the northern and western portion of the EMU.

Discussion: Agricultural fields on South Ebey, south of Highway 2, serve as resting and feeding areas for large numbers of migratory and overwintering waterfowl (see Wetlands with Sensitive Resources #23). Expansion of flooding on these fields during the winter months would significantly improve habitat value for waterfowl species. Tilling of existing pastures would be discouraged because of the high impact on the rodent and raptor population. In addition, the planting of field edges with scrub-shrub and some tree species would create cover, feeding and breeding habitat for smaller birds and promote migration of smaller mammals between larger areas of forested wetlands. For example, it is important that agricultural fields provide vegetated corridors at the base of dikes (landward side) so that they may connect forested properties such as the WDFW (Wetland Complex 83) and the Snohomish County forested wetland to the north (WC 125).

Discussions with Ebey Island farmers on the User Group (3/15/95, 4/6/95, 5/3/95) highlighted the following concerns: some of the fields may be too wet to plant off-season crops, other

crops such as corn are just as attractive as Poco Barley to waterfowl, and owners objected to the large areas initially designated for "edge of field" habitat improvement. The User Group agreed that it would be more appropriate to identify specific breaks in the smaller habitat corridors connecting larger undisturbed forested and scrub-shrub habitats on the Island and develop corridors for those breaks. Farmers emphasized that identified corridor enhancement measures must not be presented as "recommendations" but as "guidelines" under a voluntary program. Further the farmers must have control over the type of native species to be planted in any of the wildlife corridors to ensure that high maintenance species (*Salix*) do not dominate and spread into adjacent fields.

It is proposed that the habitat corridors be purchased or leased by non-profit habitat groups for the purpose of enhancing Estuary wetland habitat. The leasing or purchase agreement would include sufficient funds for the planting, monitoring and long-term-maintenance of these areas in order to prevent conflicts with adjacent agricultural operations. Leasing agreements would allow the land owner to terminate the agreement with adequate notice and return the corridor back to agricultural operation.

A waterfowl hunting program was successfully initiated in 1994 by a farmer on South Ebey Island. A hunting club leased a field from the farmer for a fee and in turn the farmer flooded the field in the winter and allowed access to the hunters during the hunting season (personal communication, E. Alexander 3/15/94).

A potential location for a canoe and kayak launch site under a leasing program is on Ebey Slough at the private dock 1200 feet north of Highway 2 with a potential landing site on the Fish and Wildlife Property Dike (WC 83). A canoe and kayak organization could lease a landing area from the Diking District. Lease provisions would stipulate limits of area for wildlife observation and provisions for terminating the lease if abuse occurs (e.g. trash left or trespass on farmer's or Fish and Wildlife property). A potential area for a hiking trail along a dike top is on the north portion South Ebey Island on the eastern side north of Highway 2. The dike could be leased from the diking district by a public entity such as County Parks. The trail would start at the east end of 12th St. S.E. which is within 50 feet of the dike top and travel north to and around the County Parks property on the north end of the Island (west portion of WC 103 and 104). This dike top is generally well buffered by vegetation (Himalayan blackberry and red alder) which would prevent trespass and maintain landowner privacy. Fees from these activities would go towards maintaining dikes. As part of a shoreline permit to the Diking District, the County required that a trail plan be developed for the top of the dike adjacent to WC 83, the Fish and Wildlife property and other adjacent properties (personal communication, Meehan-Martin 3/28/95).

Farmers also submitted a drainage plan for Ebey Island (Figure 5A.5), which depicts all of the existing ditches and drain tile locations. It was their concern that this information be reviewed by regulatory agencies when considering any regulation of potential wetland areas on the island (per. com. B. Johnson, E. Alexander 3/1/95).

County and City Lands on North Portion of South Ebey, South Spencer and East Southeast Smith Island.

Management Objectives: Conservation Wetlands within County and City ownership, park land for recreational activities and wildlife observation, and public utilities (wastewater treatment including needed expansion), and development within Group 1 wetlands (See Figure 4.3). Hunting is permitted on the north portion of but prohibited on the in the City portions of the unit and on County park property. Fishing is permitted in the sloughs.

Primary Habitat Type: Palustrine emergent, scrub-shrub, and forested habitat, tidally and seasonally flooded.

Habitat Protection Goals: Preserve conservation wetlands and protect wetlands with Special Habitat Attributes (private tidelands WC 56, 364, 357). Some expansion of wastewater treatment facility would be allowed if no feasible alternative was available.

Enhancement/Restoration Goals: Restore degraded habitat on County Parks property on South Ebey WC 103 by restoring to tidal regime consistent with wetland actions set forth on Table 5-3.

Recreation Goal: Implement recreation plan as set forth in Figure 6 of Shapiro and Associates "Snohomish Estuary Management Plan" (June 1989) or other applicable access plans that have superseded and/or amended the Shapiro Plan. This includes establishing an interpretive center and program, dike-top trail system and canoe/kayak launch (west portion of WC 103 and 104). Construct canoe/kayak launch sites on South Spencer Island. One launch site could be located beneath the 4th Street bridge connecting Smith Island with Spencer. The other launch site could be located on the east side of Spencer Island on the County-owned portion (WC 128). On Smith Island, the City of Everett bike and hiking trail should be extended north of 4th Street on the east side of the island to 12th Street N.E.. This would provide a complete loop from Langus Park, south and north around the sewer ponds and west along 12th Street N.E. to Langus Park.

Drainage District 6.

Management Objectives: Restoration to freshwater tidal wetland and passive recreational uses including ecological research, public education, wildlife observation, boating, hunting and fishing. The majority of these uses would be restricted to the main sloughs outside of the sensitive habitat of the wetlands (existing and future restored tidal wetlands). Power boats would be permitted but speed and noise would be limited to a level where " wakes" would not be created, wildlife would not be disturbed and public safety would not be endangered. Non-gasoline powered recreational boating would be encouraged including canoes, kayaks, and fishing skiffs with electric trawling motors. Motorized recreational craft, including jet skies, would be discouraged.

Proposed Primary Habitat Type: Palustrine emergent, forested and scrub-shrub habitat, tidally influenced.

Habitat Protection Goals: Protect of Group 1 forested wetlands north of Drainage District 6 and protect restored habitat.

Restoration Goals: Restore fallow and farmed agricultural fields to tidal freshwater wetlands, consistent with the SEWIP restoration plan (See Table 5.3).

Recreation Goals: Open any portion of the retained dike to public access for hiking and wildlife observation. Install canoe and kayak boat landing site at the north end of Drainage District 6.

Ecological Management Unit 2.0.

Management Objectives: Restoration to estuarine wetland (pre-disturbance conditions) east of I-5 (consistent with Table 5.3 and Figure 5.4) and continuation of existing agriculture (interim on identified restoration sites) and existing industrial uses within City of Everett west of I-5. Development of new industrial uses within the development footprint west of I-5 (see Figure 5.4). Other uses would include ecological research, public education, wildlife observation, boating, fishing and hunting. The majority of these uses would be restricted to the main sloughs outside of the sensitive habitat of the tidal wetlands (existing and future restored wetlands). Any hunting (where permitted by local ordinance), hiking and wildlife observation on land areas would require property owner permission. Power boats would be permitted but speed and noise would be limited to a level where wakes would not be created, wildlife would not be disturbed and public safety would not be endangered. Motorized recreational craft, including jet skies, would be encouraged to restrict their use to the main channel of the Snohomish River. Limited barge and tugboat traffic would be permitted on Union and Steamboat Sloughs; it is recommended that rafting of logs in these sloughs be discontinued over time. Discontinuation of hunting is recommended for Otter and Mid-Ebey Islands.

Proposed Primary Habitat Type: Estuarine emergent with secondary classes of scrub-shrub and forested habitat.

Habitat Protection Goals: Preserve existing emergent, forested and scrub-shrub estuarine habitat (e.g. Mid Ebey Island, and south end of North Spencer).

Restoration/Enhancement Goal: Restoration and enhancement of diked habitat on North Spencer Island (Biringer), Poortinga Property, and East Smith Island to estuarine marshes and mudflats for the purpose of significantly improving fish habitat, water quality improvement and food chain functions.. Enhance scrub-shrub and forested corridors adjacent to old slough channels such as Union Slough. Remove cattle from City of Everett WC 29 and enhance habitat for waterbird use.
Recreation Goal: Discourage motorized boating and encourage passive non-intrusive uses such as non-motorized boating and wildlife observation. Confine recreation users to slough channels or along designated dike-top trails.

Ecological Management Unit 3.0.

Management Objectives: Estuarine habitat, recreational/commercial boating (including marinas) and transportation corridor for limited log transportation and continuation of existing industrial uses and within the "development footprint" (Figure 5.4) continuation/expansion of existing industrial uses and development of new water dependent industrial uses. Low impact

recreation uses including hiking, wildlife observation, canoeing and kayaking. Hunting is permitted except within the City of Everett, and on tribal lands where it is restricted to tribal members only. All types of recreational boating would be permitted. For Quilceda Creek, motorized recreational boat speeds and noise should be limited so that "wakes" are not created, wildlife is not disturbed and public safety is not endangered.

Habitat Type: Estuarine habitat including tidal mudflats, saltmarsh, and brackish emergent scrub-shrub wetlands with a forested fringe.

Habitat Protection Goals: Preserve existing estuarine habitat including significant habitat adjacent to Quilceda Creek, west ends of Smith and North Ebey Islands, all mudflat habitat (except that area with “development footprint) and Maulsby mudflat and swamp. Protect wetland and upland habitat on Jetty Island.

Restoration/Enhancement Goals: Restore Union Slough portion of Biringer Farm to tidal marsh, remove log storage sites from mudflats, including discontinuing log storage along east edge of Jetty Island, and improve tidal connection between Maulsby Swamp and Maulsby Mudflat. Mudflat enhancement through removal of log rafts action is based on work that demonstrates that log rafts bottom-out during low tides and degrade benthic habitat. Log rafts located along "water-edge" units degrade the shoreline, and prevent use of the beach for feeding and access to entry points into the water. In addition, bark and log debris increase the biochemical oxygen demand in bottom sediments and cause the smothering of benthic organisms which are an important fish and wildlife food source (Simenstad 1983). Some studies have shown that these areas appear to recover rapidly once the log rafts are removed (Smith 1977). However, since the Smith study was done 20 years ago, sampling and testing parameters and methods were not necessarily consistent with current Department of Ecology sediment protocols. Also, studies in other estuaries indicate the rate of recovery of benthic populations can be highly dependent on local hydrology and log handling practices (Zegers, 1978; Pacific Northwest Pollution Control Council, 1971). Therefore, it is Ecology’s policy that sediment impacted by log rafts be sampled to determine the extent of physical and chemical impacts, in accordance with State of Washington Sediment Management Standards, prior to determining enhancement credit for log raft removal. Therefore, sediment sampling should be conducted at the log rafting site in order to determine level of toxins present, prior to granting the mitigation credit.

Recreation Goals: Implement the recreation plan for Quilceda Creek as set forth in Figure 3 of the Shapiro and Associates "Snohomish River Wetlands Management Plan" (June, 1989) and any other applicable access plans that may have amended the Shapiro document. This includes the installation of a 0.5 mile raised walkway, observational platform and canoe/kayak launch site with parking. To further encourage low impact recreational use, create a public canoe and kayak park at eastern edge of unit on either Steamboat or Union Sloughs. Implement City of Everett “Smith Island Access Plan.” Provide for wildlife observation platform and interpretive panels on the east side of the railroad tracks at Maulsby Swamp

Discussion: The one existing boat launch in the northern portion of the Estuary on Ebey Slough beneath I-5 (Marysville) would be closed when the Tulalip Tribes extend a loop road from SR 529 in Marysville to Tulalip Road. Other properties in the unit have potential upland areas of sufficient size to accommodate parking for a number of cars, a picnic area, interpretive facility

and ramps for canoe and kayak launching into either Steamboat or Union Sloughs. Because the western portion of this unit is located close to major transportation corridors (I-5 and SR 529) and close to the highest value tidal marshes in the Estuary (Quilceda Creek), it is an ideal location for a kayak and canoe park and launch site.

Development Footprint.

Management Objectives: Existing industrial use on Smith Island and along the City waterfront, including expansion and development of new industries consistent with the provisions of "Urban Wetland Complexes" set forth in Section 1.2. Industrial uses would include water dependent and other industrial uses and associated commercial boat traffic consistent with the Shoreline Master Program. Passive recreational activities would include hiking on West Smith Island, and wildlife observation on the north, south (Maulsby mudflat and swamp) and west portions of the unit and motorized and non-motorized boating throughout the unit. Hunting would not be permitted.

Primary Habitat Type: Group 3 non-tidal wetlands consisting of agricultural pasture grasses, wet meadows, freshwater marshes and scrub-shrub, forested habitat along old slough corridors (all non-tidal).

Habitat Protection Goals: Replace habitat functions and values consistent with Chapter 2 compensation policies.

Restoration/Enhancement Goals: Restore wetlands and/or riparian buffer adjacent to the west and north “diked” end of West Smith Island on Wetland Complexes 6, 7, 9, 10, and 12. The riparian buffer should be a minimum of 100 feet. Restoration area should be of sufficient width to protect adjacent Conservation wetlands from urban impacts including air, water, and soil/sediment pollution, noise, lighting, and human presence.

Recreation Goals: Provide recreational access consistent with the City of Everett "Smith Island Access Plan."

Discussion: Significant areas of Group 1 and Conservation wetlands are located to the west and north of this unit. To protect these wetland areas, any future development must be set back a sufficient distance to allow for re-establishment of wetland habitat in the intervening disturbed areas. A User Group committee member commented that a portion of this unit west of SR 529 still provides significant habitat for waterfowl and wildlife and that the wetlands between SR 529 and I5 should be restored (Zalesky, 2/8/95 letter).

Ecological Management Unit 4.0

Management Objectives: Open space for estuarine and palustrine wetlands (seasonally flooded), scrub-shrub and dune habitat, recreation, wildlife observation, research and education; recreational and commercial boating, and sport and commercial fishing. Hunting is not permitted on Jetty Island.

Primary Habitat Type: Estuarine open water habitat with extensive sandflats and mudflats. Scattered palustrine emergent wetlands are present on Jetty Island with dune and upland scrub-shrub vegetation. Small areas of saltmarsh are located along the northeast and southeast edge of the Island.

Habitat Protection Goals: Preserve existing estuarine habitat. Install interpretive signs at palustrine wetland and salt marsh locations to prevent unintentional access and damage to habitat. Implement the Jetty Island Management Plan.

Restoration/Enhancement Goals: Convert Scotch broom upland habitat to native species. Implement recommendations of the Jetty Island Management Plan (Port of Everett).

Recreation Goal: Investigate establishment of overnight "marine trail camping area" as part of the Cascadia Marine Trail (State legislature created permit system in April of 1993) on Jetty Island or other units in western portion of Estuary. Create a more comprehensive trail and interpretive system with raised boardwalk in sensitive areas such as the salt marsh on the northeast portion of the island. Implement recommendations of the Jetty Island Management Plan (Port of Everett).

Ecological Management Unit 5.0

Land Use: Port of Everett industrial area including deep water port, terminals and dock space for loading/unloading of raw and finished materials/goods, log rafting, manufacturing, marine repairs, naval station, marinas, boat launches, water dependent and water oriented commercial (includes visitor serving facilities), and recreation and commercial boating. Within “development footprint” (Figure 5.4) expansion of existing industry and development of new industry consistent with Chapter 2 Compensation policies.

Habitat Type: Hard substrate including rock rip-rap, bulkheads, concrete and wood pilings and estuarine mudflats and emergent wetland with scrub-shrub and forested edge.

Habitat Protection Goals: Replace any losses of existing mudflat and emergent wetland habitat functions and values consistent with Chapter 2 compensation policies.

Recreation Goals: Maximize public access to the shoreline through implementation of the City of Everett Shoreline Access Program. Protect existing shoreline access at 12th Street boat launch, and at Maulsby Mudflat and Marina Village. Provide for wildlife observation platform and interpretive panels on the east side of the railroad tracks at Maulsby Swamp.

Ecological Management Unit 6.0.

Land Use: Open space for intertidal beach habitat and limited Port of Everett expansion northeast of Pigeon 2. Recreation uses include walking, jogging, swimming, sunbathing, and recreational boating, including a kayak and canoe landing site at Howarth Park. Hunting is not permitted.

Habitat Type: Intertidal beach habitat, rocky and sandy shores.

Habitat Protection Goals: Protect existing intertidal beach habitat and creek mouths.

Restoration/Enhancement Goals: Restore small coastal lagoon at the mouth of Pigeon Creek 2 by removing accumulated sediment.

Recreation Goal: Protect existing low impact recreational uses along the sandy beach including use of Howarth Park as a rest stop for non-motorized recreational boaters.

5A.3 Conservation Wetlands

These are Group 1 wetland complexes (based on combined Wildlife/Water Quality Improvement Attribute rankings -- Figure 4.3) that are presently in public or tribal ownership or are recreation/open space areas in park ownership within any of the Wetland Categories or are restoration sites. Figure 5a.2 shows the location of these Conservation Wetlands. These areas consist primarily of undisturbed wetland habitat without other uses predominating on the complex. It is recommended that alteration of these wetlands be limited to restoration and enhancement activities and minimal recreational improvements. Any existing detrimental uses, such as grazing and log rafting, should be permitted to continue but are encouraged to phase out over time.

The area with the highest concentration of Conservation Wetlands and the presence of Priority Species is centered on Otter, Mid- and South-Spencer, Mid- and North-Ebey Islands, and West tip of Smith Island and Quilceda Creek Wetlands. From a wildlife and water quality standpoint, the greatest existing challenge is the lack of adequate management of adjacent urban and rural uses that may impact these wetlands. Though adjacent uses are primarily agricultural, the creation of more natural open space habitat (scrub-shrub and forested habitat) would protect and significantly improve the habitat value of these conservation areas. Because there are priority nesting species in these areas such as bald eagles and ospreys, a 600- to 1000-foot buffer is recommended for lands adjacent to this “core group” of Conservation Wetlands listed above (Buffer Needs of Wetland Wildlife, WDFW 1992). Further detailed wildlife studies of animal distribution and abundance and habitat structure may be necessary to provide the basis for site-specific buffer recommendations.

General management recommendations for wetland and riparian areas are available from the Washington Dept. of Fish and Wildlife (WDFW undated and 1994) as guidelines to direct, rather than dictate, site-specific activities. Because the recommendations are generalized to cover a type of wetland across the entire state, fine-tuning may be necessary when applying them to specific site conditions. Consultation with professional biologists will be necessary for such fine tuning.

Design and implementation of management activities should strive to retain or restore structural and functional characteristics important to fish and wildlife (WDFW 1994). These characteristics include habitat connectivity; vegetation diversity in terms of age, plant species composition, and layers; vegetation vigor; abundance of snags and woody debris; natural rather

than human-induced disturbance; and irregular shape, width, and depth that resemble natural conditions.

The following is a list of Conservation Wetlands, both tidal and non-tidal, in public and/or tribal ownership:

a) *Vegetated Tidal Wetlands*, including Quilceda Creek (WC 131, 132, 133, 170), North Ebey Island (WC 135, 136, 158,), Marysville Mitigation Site (WC 145), Mid Ebey Island (WC 141, 144, 359), East Mainland north of Otter Island (partial tidal WC 139, and full tidal 179), Otter Island (105), Mid Spencer Island (WC 138, 304), South Spencer (WC 127, 128, 129), Mainland adjacent to Ferry-Baker Island (WC 256 - City of Everett Parks ownership), Langus Park (WC 53), North Simpson Lee Wetlands (WC 311).

b) *Vegetated Palustrine Wetlands (diked),* including South Ebey Island (west portion of 103 and 104 County Parks, east portion of WC 125 County Parks, WC 83 Washington Dept. of Fish & Wildlife, WC 69, WC 70 and northeast portion of WC 62 Department of Transportation), south and east portions of Smith Island (WC 33, 45, 48, 49, 50, 55 City of Everett), Rotary Park (WC 192, City of Everett), Simpson Lee (WC 307 Bigelow Creek, City of Everett), and non-tidal portion of west Mainland southwest of Ferry-Baker Island (WC 256).

A brief description of some of the more significant Conservation wetland complexes is provided below:

1) Quilceda Creek and North Ebey (Wetland Complexes 131-133,135, and 181).

Local Significance: Black or Indian rice lily and high quality native plant communities.

Habitat Usage: Nesting habitat for bald eagles and ospreys and foraging habitat for red-tailed hawk. The tidal wetland complexes in this area are among the most pristine in the study area and support rare plant species (black or Indian rice lily), high quality native plant communities and wetland types (Norwood, 1994). There is a bald eagle nest and several osprey nests in the area. SEWIP field teams also observed red-tailed hawks in the area. These wetlands are under the jurisdiction of the Tulalip Tribes.

2) Mid-Ebey Island (WC 141, 144, 359)

Local Significance: Largest cattail and bulrush marsh (approximately 248 acres) in Estuary.

Habitat Usage: Provides habitat for wood duck, great blue heron, Caspian tern, red-tailed hawk, Northern harrier, osprey, Canada geese, Lewis' woodpecker, kingfisher, passerines, deer, muskrat, beaver and river otter (SEWIP field personnel, 6/15/94 and Snohomish Wetland Alliance Notebook, undated). The eastern and southern margin of these wetlands are dominated by scrub-shrub and forested habitat consisting of black twinberry, Nootka rose, crabapple, ninebark, Douglas spirea and Sitka spruce and red alder. Complexes are owned by the Snohomish County.

3) Otter Island (WC 105)

Local Significance: The majority of this 164-acre island has never been cleared or farmed and represents the historic conditions within the Estuary. Minor clearing and ditching appears to have occurred in the past on the southwest corner of the island.

Habitat Usage: The island provides very diverse habitat consisting of a Sitka spruce swamp along the periphery and western half of the complex and a cattail/bulrush marsh in the central portion. The scrub-shrub understory consists of Nootka rose, black twinberry, salmonberry, and crabapple. Other emergent plants include skunk cabbage, cow parsnip, and Lyngby's sedge. This complex is located within the nesting territory of bald eagles and provides them wintering habitat. The forested habitat is used by mink, raptors, and wood duck for nesting and breeding, with deer and muskrat using it for feeding (Shapiro 1989). Red-winged blackbirds, bitterns, rails and waterfowl use the marsh habitat for feeding and nesting (Shapiro 1989). This island is in Snohomish County ownership.

4) Nyman Farm (Wetland Complexes 139 and 179).

Local Significance: Nesting habitat for bald eagles and feeding habitat for grouse.

Habitat Usage: This Snohomish County owned area, just north of Otter Island on the east bank of Ebey Slough, is a vital buffer and link to habitat on Otter Island. Bald eagles and osprey have nested here and grouse feed on cottonwood.

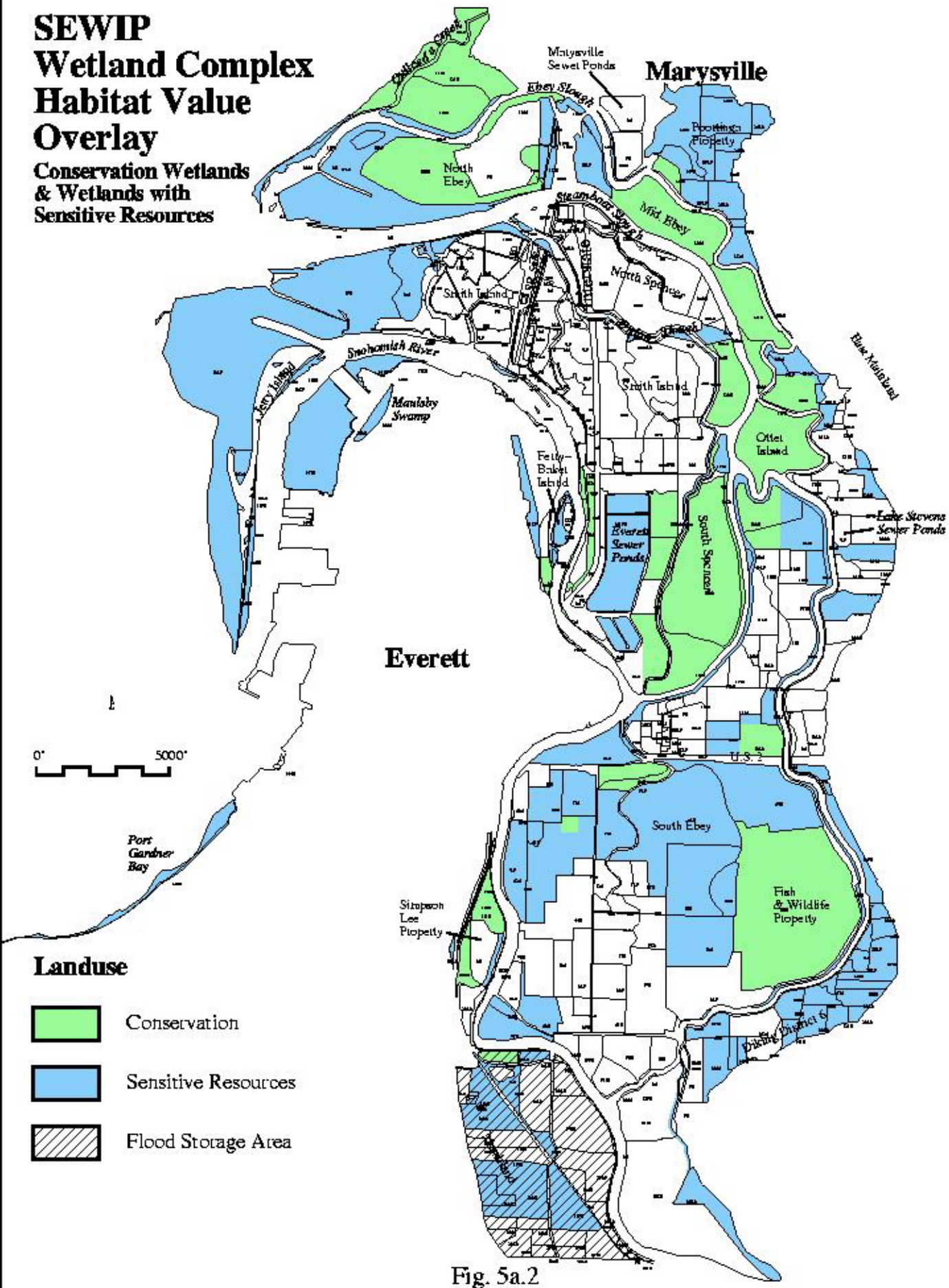
SEWIP
Wetland Complex
Habitat Value
Overlay
Conservation Wetlands
& Wetlands with
Sensitive Resources
Marysville
Everett
Ebey Slough
Steamboat Slough
Snohomish River
Union Slough
Ebey Island
Smith Island
North Ebey
Mid Ebey
North Spencer
South Spencer
Ferry-Baker Island
Otter Island
Marsh Island
Maulsby Swamp
Marysville Sewer Ponds
Everett Sewer Ponds
Lake Stevens Sewer Ponds
Port Gardner Bay
South Ebey
Fish & Wildlife Property
Simpson Lee Property
Pooting Property
U.S. 2
Diking District 6
0'
5000'
Landuse
Conservation
Sensitive Resources
Flood Storage Area

Fig. 5a.2

5) Mid-Spencer Island (WC 138, 304)

Local Significance: An 83 acre Lyngby's sedge and cattail/bulrush marsh with a forested fringe of Sitka spruce and red alder. Popular waterfowl hunting and wildlife/bird observation area.

Habitat Usage: Within the nesting and wintering territory of bald eagles. Provides feeding, nesting and resting habitat for a variety of waterfowl species including wood ducks, widgeons, scaup, mergansers, blue wing and green wing teal, Canada geese and gadwalls (Snohomish Wetland Alliance Notebook, undated). Occasional use by peregrine falcon when Western sandpiper and dunlin are present (Snohomish Wetland Alliance Notebook, undated). Small mammals, passerines, and raptors such as the Northern harrier use the forested fringe on this wetland complex. Complex is in the Snohomish County ownership.

6) South Spencer Island (WC 127, 128, 129)

Local significance: This 437 acre Island provides habitat for a diverse assemblage of birds and other wildlife.

Habitat Usage: Excellent waterfowl habitat is present on the northern portion of the Island (WC 129, owned by Washington State Fish and Wildlife). The southern portion of the site (WC 128) is one of the largest ongoing tidal restoration efforts in the Estuary (owned by Snohomish County, Parks Department). This Island is a popular duck hunting and wildlife observation area. Waterfowl observed include Canada geese, gadwall, lesser scaup, shovelers, ruddy ducks, blue wing and green wing teal (nest on Island), mallards and pintails (Snohomish Wetland Alliance Notebook, undated). Also observed were wood ducks, great blue heron, red tail hawk, bald eagle, osprey, great horned owl, barn owl, Bewicks wren, killdeer, tree and barn swallows, kingfishers, red-winged blackbird, deer, raccoon, and red fox (SEWIP field personnel 6/12/94). The northern part of the Island is dominated by a reed canary grass and cattail marsh surrounded by a scrub-shrub and forested fringe of nootka rose, Douglas spirea, Himalayan blackberry, red alder, Sitka spruce, willow, paper birch and the occasional cottonwood.

7) Northwest Portion of South Ebey Island (West portion of WC 103 and 104)

Local Significance: Relatively diverse scrub-shrub, forested and wet meadow habitat that enhances and protects the significant habitat values of Otter Island located immediately to the north. Serves as nesting and wintering territory for bald eagle.

Habitat Usage: A variety of wildlife use the site including small mammals, raptors, river otter (SEWIP field personnel 6/1/94), coyote, deer, pileated woodpecker (Shapiro 1989), as well as wood ducks, mallards, great blue heron and cedar waxwings (SEWIP field personnel 6/1/94). Reed canary grass, soft rush and cattail dominate the emergent portions of the site, with a mix of Himalayan blackberry, red elderberry, red alder, Nootka rose, Douglas Spirea, salmonberry, willow and red-osier dogwood in the scrub-shrub layer. A forested component is present primarily in the northern portion consisting of Sitka spruce, red alder and a trace of cottonwood and paper birch. This 93-acre parcel is owned by Snohomish County Parks.

8) Fish and Wildlife Property, South Ebey Island (Wetland Complex 83)

Local Significance: Largest and most pristine non-tidal forested swamp within the Estuary. This approximately 520-acre wetland represents about 60% of the fresh water swamp in the Estuary (Shapiro 1979).

Habitat Usage: This diverse wetland habitat supports a large and varied wildlife population including raptors, songbirds, deer, mink, raccoon and numerous other mammals (Shapiro 1979). SEWIP field personnel have observed red-tailed hawk, Northern harrier, wood duck, gadwalls, yellowthroat, porcupine, beaver and a large coyote den complex on northeast end of complex (8/18/94). The emergent community consists of several rush and sedge species, skunk cabbage, lady fern and reed canary grass, with the scrub-shrub layer comprised of ninebark, willows, crabapple, black twinberry, Douglas spirea, salmonberry, and red osier dogwood. Western red cedar, Sitka spruce, red alder, lodgepole pine and scattered black cottonwood make up the forest canopy.

9) Langus Park (Wetland Complex 53).

Local Significance and Habitat Usage: Largest riverfront park (City of Everett) in Estuary. Resting and feeding habitat for a variety of waterfowl, shorebirds, passerines and raptors. Langus Riverfront Park and Nature Trail (Smith Island) is featured in the *Washington Wildlife Viewing Guide* (LaTourrette, 1991) as an area to view a variety of song birds, including red-winged blackbirds, with a high probability of seeing waterfowl, raptors and shorebirds year round.

10) South Tip of East Smith Island (Wetland Complex 55).

Local Significance and Habitat Usage: Nesting and roosting area for raptors. This area functions as a nesting and roosting area for raptors, such as the great horned owl and red-tailed hawk. A pileated woodpecker was identified by call in the alder forest on the south end of Smith Island (P. Meehan-Martin, 4/25/94, unpublished data). The SEWIP field personnel observed a pileated woodpecker in this wetland complex during assessment of the outer edge of WC 127 (see inventory sheets).

11. Marysville Mitigation Site (Wetland Complex 145)

Local Significance: One of the first tidal restoration projects in the Estuary. Restoration is mitigation for impacts at the Marysville sewer plant.

5A.4 Wetlands with Sensitive Resources

Wetlands with sensitive resources have significant and/or unique assemblages of species or habitat present that may not have been identified by the IVA wetland assessment and are not in public ownership. Figure 5a.2 shows the location of these wetlands. The majority of these wetland complexes are Group 1 wetlands (Figure 4.3) under the combined Water Quality and Wildlife Attributes rankings, with a limited number falling within the Group 2 and 3 rankings. The following is for informational purposes only and may assist local, state and federal agencies in their planning, management, regulatory, and restoration efforts in the Estuary.

For example, an urban wetland such as Maulsby Mudflats (WC 167) contains habitat elements or species that are unique or uncommon in the study area but are not reflected in the IVA assessment (Group 2 mudflat -- species assemblage seems to indicate a Group 1 wetland ranking). Maulsby Mudflat supports some of the highest concentrations of shorebirds in the study area and is also used by bald eagles, peregrine falcons and ospreys (osprey nest is also located on its western edge). Compensation measures for any potential development should have to provide for protection of an area in the northern portion of the mudflat (adjacent to Maulsby Swamp, WC 316) sufficient to continue support of shorebirds and waterfowl usage. Compensation would also have to address enhancement of the fisheries function of the mudflat and replacement of all other lost functions and values.

Provided below is a detailed description of most wetland complexes with Sensitive Resources. Not all wetlands shown on figure 5a.2 with a sensitive habitat overlay are discussed below. These wetland complexes were identified by, local experts, SETAC and other resource agency staff. They consist of a wide range of habitat, including mudflats, salt marshes, brackish and fresh water tidal marshes, forested and scrub-shrub swamps, and wet meadows.

1) Maulsby Mudflat and Preston Point Mudflat. (WC 167 - South of Preston Point and "Nord Door, WC 161 Preston Point at mouth of Snohomish River).

Local Significance: Largest concentration of shorebirds in Estuary.

Habitat Usage: Overwintering and spring and fall migration for shorebirds and waterfowl.

The Maulsby mudflats are heavily used by shorebirds and waterfowl, including the only other known concentration, outside of the Everett Oxidation and Polishing Ponds, of black duck in Puget Sound (Meehan-Martin, pers. comm. 1/24/95). Meehan-Martin reported 4500 dunlin and western sandpipers (P. Meehan-Martin, 5/1/94, unpublished data). Other observers have reported bald eagles, peregrine falcons, nesting waterfowl, and up to 4,000 shorebirds (Carroll, pers. comm. 11/8/94). Purple martins have been reported to nest in old woodpecker holes in the area (Mlodinow, pers. com., November 22, 1994). For the mudflat area north of Maulsby (WC 161, Snohomish River Mouth) up to 3000 dunlin and 500 western sandpipers have been observed (Cascadia Research unpublished data for Nov. 27, 1993 ground count supplied by P. Meehan-Martin 5/3/94).

2) Maulsby Swamp (WC 316).

Local Significance: Largest remaining tidal wetland on the west side of Everett mainland.

Habitat Usage: This area provides feeding, rearing, overwintering and shallow water refuge for fish species. The export of nutrients from Maulsby Swamp directly into the Maulsby mudflats probably has an important influence on the number and diversity of benthic organisms present there. Smith (pers. com. 11/8/94) has observed a red-shouldered hawk at the swamp and frequent perching in the wetland buffer by a pair of bald eagles that nest in Legion Park. Other fish eating birds such as great blue heron frequent this wetland complex.

3) Jetty Island (Wetland Complexes 163, 182, 183, 185, 186, 187, 188, 189, 190, 191, 367).

Local Significance: Dredge spoils island in Port of Everett ownership with high habitat and education/recreation value for public.

Habitat Usage: Overwintering and spring and fall migration for shorebirds and waterfowl; breeding habitat for northern harrier and short-eared owl; feeding habitat for bald eagle, osprey and peregrine falcon.

Brunner (1988) found that the terrestrial habitats of this island were most important for wintering and breeding birds (such as northern harriers and short-eared owls) and less important for migrants. Intertidal habitats supported wintering shorebirds (particularly dunlin) and waterfowl (particularly black brant). Spring migrants included shorebirds (especially western sandpipers) and western grebes (more numerous in deeper waters). Lower numbers of birds would be expected in summer. Nesting species included glaucous-winged gulls and possibly Canada geese and spotted sandpipers. Several species of passerine birds such as song sparrow, barn swallow, American robin, Bewick's wren, northern flicker, and ruby-crowned kinglet were also observed on the island. Bald eagle and osprey feed in this area (offshore mudflats, WC 163 and 183) and in the fall shorebirds, waterfowl, grebes, and falcons feed on the island.

Three immature bald eagles and numerous great blue heron were observed foraging for fish during a low tide on the mudflats west of Jetty Island (WC 183) (SEWIP field personnel 8/18/94).

Carroll (1991b, 1992) also indicates that this area is important for shorebirds and waterfowl. Carroll studied peregrine falcon and bald eagle use of the island and documented 117 bird species including passerine birds, shorebirds and waterfowl, including black duck on the eastern edge of the island (personal communication, Janet Carroll, 3/27/95).

Carroll found that Jetty Island and the adjacent mudflats provide excellent foraging habitat for bald eagles. Bald eagles were observed on Jetty Island every month of the year (except September) with up to 20 observed at one time (Carroll 1992). Additionally, Jetty Island is within the foraging range of four pairs of nesting bald eagles (Carroll 1992). Though observed perched throughout the Island, bald eagles were observed most frequently on mudflats and the beach north of the berm. The mudflats were found to be most important to subadult eagles who concentrate in areas of high prey availability (Carroll 1992).

Peregrine falcons have been observed seven times on Jetty Island with other evidence of their presence consisting of five bird carcasses found on the Island (Carroll 1992). The first documented record of a peregrine falcon in the Snohomish delta was made on September 23, 1988 when a falcon killed and ate a Bonaparte's gull on Jetty Island (Carroll 1992). Root wads on the Island were observed being used as perches by peregrines (Carroll 1992). Carroll concluded that the Snohomish Estuary has a prey base adequate to support a number of peregrines in the winter (1992).

The most prominent mammal species Carroll found were river otter, coyote and Townsend's vole. In 1991 a coyote was observed on the north end of the island and later that year a coyote carcass was found in the same area. A river otter den was noted along the east shoreline the island. Voles, a major raptor prey species, inhabit the grassy areas on the north end of the island.

Recent shorebird censuses at Jetty Island show high numbers of dunlin (up to 3,000), western sandpiper (up to 1,500), and other species (Evenson and Buchanan, 1994; Cascadia Research, unpublished data supplied by Janet Carroll 12/13/94). Wahl and Paulson (1991) indicate that as many as 200 California sea lions have hauled out on the island in the past.

4) West Smith Island Mudflats (Wetland Complex 19)

Local Significance: Largest concentration of nesting double-crested cormorants and ospreys in the Estuary.

Habitat Usage: Nesting and overwintering habitat for migrating shorebirds and waterfowl. This area supports a colony of nesting double-crested cormorants, the largest in the study area, as well as osprey nests. This area is also wintering and migratory habitat for waterfowl and shorebirds.

5) West Smith Island Vegetated Tidal Wetlands (WC 18, 13)

Local Significance: One of three areas in the Estuary where tidal habitat is essentially in its historic un-degraded condition. These important wetland complexes contain the full range of estuarine habitats, gradating from mudflats on the west (WC 18) to low and high saltmarsh and brackish marsh on the east, bordered by scrub-shrub and forested wetlands.

Habitat Usage: Shorebird and waterfowl, resting and feeding area, including sanderling, dunlin, sandpiper, mallard, northern shoveler, and northern pintail. Songbirds such as blackbird, marsh wren and song sparrow use the upper brackish cattail/bulrushes marshes and scrub-shrub habitat.

6) Ferry-Baker Island Complex (Wetland Complex 254, 282, 255, and 365).

Local Significance: Only island habitat within the Snohomish River in the City of Everett.

Habitat Usage: Complex is unique in that it contains mudflat habitat, brackish marsh and scrub-shrub and forested habitat within an urban setting. Habitat is relatively undisturbed except for upland portions (WC 254) which were once used for log storage. Area is used by a variety of waterfowl and raptors for resting and feeding, including double crested-commorant, northern harrier, belted kingfisher and Canada geese. A red-tailed hawk nest is located in the forest canopy (personal communication, Paul Meehan-Martin 3/27/95)

7) North End of East Smith Island (WC 41)

Local Significance: Small but diverse tidal island within Union Slough that has not been diked and is well buffered from human activity.

Habitat Usage: Emergent, scrub-shrub habitat consisting of Lyngby's sedge, common cattail, crabapple and red-osier dogwood is present. Wildlife species listed in Table 2.3 for these vegetation classes are expected to occur on-site.

8) West Edge of North Ebey Island (WC 134 and 171)

Local Significance: Largest concentration of nesting osprey in Estuary.

Habitat Usage: This area supports the greatest local numbers of nesting osprey within the Estuary. During July-November of 1993 25 osprey were observed (WOS Field Notes 1-3).

9) Poortinga Property (WC 146, 147, 339-43, and 360-363)

Local Significance: Large concentration of wintering and migratory waterfowl.

Habitat Usage: Resting and feeding habitat for overwintering and Spring migration waterfowl. This area supports wintering and migratory waterfowl, and is an example of secondary or overflow wintering habitat provided by agricultural land further inland in the Estuary. Wetland habitat planning should provide secondary habitat areas for waterfowl (Lovvorn, 1995) in urbanizing areas.

10) North Ebey (WC 148, 150, 153, 154, 156, and 157)

Local Significance: Large cattail, bulrush and Lynby's sedge tidal marsh that can be readily viewed from I-5 and SR-529. These wetlands have high educational value.

Habitat Usage: It is used by a variety of birds and animals including coyotes (SEWIP field personnel 7/6/94) red-winged blackbirds (nesting) and great blue herons (feeding).

11) Northeast Mainland, Sunnyside (WC 143 and 258)

Local Significance: One of only three large forested tidal swamps (one is partial tidal, WC 139) along the eastern boundary of Ebey Slough. These wetlands are relatively undisturbed and are probably representative of the historic conditions within the Estuary prior to diking. Minor diking is present on WC 143, but it is broken in several areas.

Habitat Usage: All three classes of vegetation are present, with a diverse assemblage of plant species. The emergent class species includes Lyngby's sedge, hardstem bulrush, common cattail, and skunk cabbage; the scrub-shrub class species include black twinberry, Nootka rose, and crabapple; and the forested class includes Sitka spruce. Red-tailed hawk, goldfinch and marsh wren have been observed on-site.

12) North Spencer, South End of Biringer Farm (WC 302 and 303)

Local Significance: The northernmost remnant of relatively undisturbed wetland habitat. All areas north and west are severely degraded by intense cultivation.

Habitat Usage: Wetland Complex 302 is a small tidal wetland with a very well buffered tidal channel that supports large populations of three-spined stickleback. This wetland is probably a favorite feeding area for fish-eating birds, including great blue herons. Evidence of coyote was seen in this complex (SEWIP field personnel 8/23/94). Wetland Complex 303 is a diverse emergent, scrub-shrub and forested diked palustrine wetland with a small area of ponded

water. The forest is dominated by red alder, with the scrub-shrub component consisting of willows, crabapple, and hardhack spirea. Wildlife species listed in Table 2.3 are expected to occur on this site for all three vegetation classes.

13) North Tip of South Spencer (WC 137)

Local Significance: The only portion of South Spencer that was not successfully diked and farmed. This wetland complex has similar elevations to Otter Island and has the potential, therefore, to be restored to a similar type of forested and scrub-shrub habitat.

Based on review of Snohomish County air photos, this complex was not intensively farmed, but diking and ditching activities occurred between 1974 and 1978 which visibly altered the vegetation composition (Snohomish County Air Photo Series , Sec 10, T29N, R5E, 1947 to 1991). Some limited farming occurred in the 1940's when onions were raised without heavy farming equipment; the farmer gained access to the complex by rowboat (Bob Haskel, personal communication 4/4/95). Because the surface elevations in this tidal marsh are similar to those of Otter Island, restoration of this wetland to a Spruce Swamp is feasible. This is not immediately possible with most of the farmed wetlands due to significant subsidence.

Habitat Usage: Presently this complex is a diverse assemblage of emergent and scrub-shrub species, including: common cattail, skunk cabbage, reed canary grass, black twinberry, Nootka rose, crabapple, and some scattered Sitka spruce.

14) East Mainland, East of Otter Island (WC 210 and 358)

Local Significance: These emergent partial tidal wetlands are immediately east of the high value forested habitat on WC 139. These habitats have the potential to further buffer and protect WC 139.

Habitat Usage: This wetland is designated as having a Priority Species present by the WA Dept. of Fish and Wildlife.

15) Northeast End of South Ebey Island (WC 103, 104,106)

Local Significance: Medium-sized forested, scrub-shrub and emergent habitat that is one of only three similar sites north of Highway 2 on Ebey Island.

Habitat Usage: These wetland complexes consist of a mosaic of grazed fields dominated by reed canary grass and a diverse shrub-shrub and forested habitat. Immediately to the north is Otter Island, a relatively pristine conservation wetland. These complexes have the potential to enhance and buffer the higher value conservation wetlands to the north. Wood ducks, yellowthroat, tree and barn swallows, song sparrows and red-tailed hawks have been observed on these sites.

16) East Mainland, South of Lake Stevens Sewer Plant (WC 221)

Local Significance: Fallow agricultural field with two ponds on-site and adjacent stream channel.

Habitat Usage: Area is dominated by reed canary grass but has high potential for restoration. Great blue heron observed on-site. Heavy bird use at City of Lake Stevens sewer pond immediately to the north.

17) South Ebey Immediately North of Highway 2 (WC 356, west third of 125, and 125, 125.1)

Local Significance: Fallow agricultural fields and forested fringe that are adjacent to a medium-sized mature Sitka spruce and Western red cedar forested habitat (one of only three sites north of Highway 2 on South Ebey).
Habitat Usage: Though dominated by reed canary grass, this complex is transitioning into a scrub-shrub habitat consisting of willows, hardhack spirea, red alder and black twinberry. This habitat has a high potential for restoration to a scrub-shrub habitat, given its proximity to a high value forested habitat and presence of organic soils (Mukilteo muck). Cedar waxwing, bald eagle (4/7/95), and downy woodpecker have been observed onsite (SEWIP field personnel).

18) Southwest Ebey Island Immediately North of Highway 2 on Snohomish Channel (WC 56)

Local Significance: Largest tidal marsh on South Ebey Island.

Habitat Usage: Very diverse emergent, scrub-shrub and forested habitat with well-developed channel system. Lyngby's sedge, common cattail, skunk cabbage, willows, red-osier dogwood, ninebark, crabapple, red alder, Sitka spruce and black cottonwood are present on-site. Observed wildlife includes wood duck hen, cedar waxwing, red-winged blackbird, killdeer, Swainson's thrush, river otter feeding, and long-tailed weasel.

19) Southwest Ebey Island Immediately South of Smith Island on Steamboat Slough (WC 357)

Local Significance: This tidal emergent, scrub-shrub and forested wetland and mudflat is a continuation of high value WC 56 to the south.

Habitat Usage: In conjunction with WC 102 (water-edge unit) and habitat on South Spencer, this wetland serves as an important link between the large areas of pristine habitat on Otter and Mid Ebey Islands and the forested non-tidal habitat on South Ebey.

20) South Ebey Island on West Side (WC 57, 58, 61, 62, 63)

Local Significance: Second largest forested habitat on South Ebey south of Highway 2.

Habitat Usage: This mature forested swamp with adjacent wet meadows to the north, is located on organic soils (Mukilteo muck) and contains Sitka spruce, red alder, western red cedar, willows, red-osier dogwood, hardhack spirea, black twinberry, skunk cabbage, common cattail, reed canary grass and various rushes. The forested portion (WC 62 and 63) of these complexes is relatively un-degraded with a nesting pair of red-tailed hawks, extensive beaver activity and amphibians observed.

21) Mid South Ebey Immediately South of Highway 2 (WC 71, 81, 82, 92)

Local Significance: Second largest forested habitat on South Ebey Island.

Habitat Usage: Though the emergent areas of these wetland complexes are presently grazed, its combination of wet meadow (soft rush), organic soils, high degree of water interspersion, and vegetation mosaic of three large patches of mature forested western red cedar/Sitka spruce and willow/ alder swamps makes this a highly diverse as a wetland habitat. Considerable wildlife activity was noted including long-tailed weasel (fresh kill) and unidentified predator, ground squirrel, red-winged blackbird, red-tailed hawks and their nest on north end, various passerine birds and Pacific tree frog (SEWIP field personnel 9/24/94).

22) S. Ebey Island South of Hwy 2 (WC 80, 84)

Local Significance: Large concentration of wintering and migrating waterfowl.

Habitat Usage: Habitat for overwintering and Spring migrating shorebirds and waterfowl and foraging habitat for northern harriers and red-tailed hawks. This area supports wintering and migratory waterfowl (Meehan-Martin, pers. comm 11/8/94), including trumpeter swans, and raptors such as northern harriers and red-tailed hawks.

23) South Ebey Island, Southwest Corner (WC 67, 68, and 206).

Local Significance: Fourth largest forested habitat on South Ebey, south of Highway 2.

Habitat Usage: This unique area contains a large emergent wetland (WC 67, presently farmed) and forested, scrub-shrub habitat (WC 206) that is outside of the main dikes and therefore subject to flooding on a more frequent basis. The field area is used heavily by migrating and overwintering waterfowl when winter flooding is maintained by the property owner (pers. comm. Everett Alexander 1/31/95). The larger adjacent forested area (WC 68) is located inside the dikes and consists of a diverse assemblage of plant species, including western red cedar, red alder, Sitka spruce, willow, cottonwood, red-osier dogwood, crabapple, salmonberry, skunk cabbage and lady fern. Considerable wildlife activity was noted in this area. Numerous bird species were also observed, including red-tailed hawk, Swainson's thrush, song sparrow, rufous-sided towhee, and a pileated woodpecker hole. Great blue herons and immature coyotes were observed in WC 206 (SEWIP field personnel 7/29/94).

24) Drainage District 6 & Tidal Wetland to North (WC 96, 227, 230, 231, 232, 233, 235, 236, 239, 237, 238, 240, 241, 245, 246, 249, 331, 332)

Local and Regional Significance: Large concentration of wintering and migrating waterfowl. This area has been recognized as an important area for restoration in the Washington State Component of the North American Waterfowl Management Plan for the Pacific Flyway (Pacific Joint Venture, undated). The Plan recommends that 450 acres within Drainage District 6 be returned to tidal inundation. Also includes large forested tidal wetland, 227, to the north.

Habitat Usage: Habitat for overwintering and spring migrating shorebirds and waterfowl and foraging habitat for northern harriers, red-tailed hawks, and great blue heron. Extensive beaver activity in northern portion of complex, in addition to evidence of river otter, long-tailed weasel and coyote and observation of a young buck (SEWIP field personnel, 7/94). Over 800 ducks

have been observed within this area, including mallard, widgeon and pintail (Meehan-Martin, 11/94, unpublished data).

25) Swan Slough (WC 253 and east edge of 251)

Local Significance: Provides valuable habitat corridor from Ebey Slough to forested upland habitat on Fobes Hill. Area has the potential to provide a habitat corridor connection to Drainage District 6 once it is restored.

Habitat Usage: A freshwater, seasonally flooded scrub-shrub and emergent marsh. Gadwalls, goldfinches, song sparrows and great blue heron have been observed on this site (SEWIP field personnel 7/28/94). The slough consists only of a narrow margin along the eastern edge of Wetland Complex 251 (agricultural field), widening to a broader more diverse habitat on Wetland Complex 253.

26) Marshland Drainage District (WC 193, 196, 199, 202, 322, 323, and 330)

Local Significance: This series of complexes contains the largest mature western red cedar and Sitka spruce swamp (WC 193) west of the Snohomish River within the City of Everett.

Habitat Usage: The habitat is unique in that it is fed by several streams, is partially underlain by organic soils (Mukilteo muck and terric medisaprists) and has an abundance of wildlife present within an urban setting. Wildlife observed in wetland complex 193 included great blue heron, greenback heron, kingfishers, Swainson's thrush, song sparrows, fawn (carcass), adult deer, and opossum (carcass) in the southern complexes (SEWIP field personnel, 7/12/94). WC 202 and 199 consist partially of fallow agricultural fields which are developing a more diverse emergent and scrub-shrub vegetation consisting of skunk cabbage, common cattail, bittersweet nightshade, ninebark, hardhack spirea, Nootka rose, willow and alder. Wetland Complex 323 is also a fallow agricultural field. Wetland Complexes 322, 330, 325 are cultivated fields with streams running through them connecting to the Marshland canal. Overall, the habitat within these complexes provides a linear corridor connecting the Marshland Canal with the upland forest corridor running along the Lowell bluffs to Wood Creek. Other wildlife expected in this area includes those species listed in Table 2.3 for all three vegetation classes.

5A.5 Wetlands with Social Significance (Group I)

This overlay category (Figure 5A.3) includes those wetland complexes which had a Group 1 classification for any of the Social Significance Attribute functions (Recreation, Aesthetics, Access to Transportation/ Shoreline Stabilization). The only specific recommendations for these wetlands pertains to the recreation function.

5A.5.1 Recreation in the Snohomish Estuary. The recreational goals and recommendations were developed with the assistance of Werner Furrer of the User Group.

The Snohomish Estuary is a unique recreational resource. It is immediately adjacent to the City of Everett, the largest city within Snohomish County, within 20 miles of the City of Seattle and

immediately adjacent and connected to the Puget Sound, a major recreational area. Unlike Commencement Bay in Tacoma and the Duwamish River Estuary in Seattle, the Snohomish Estuary has not been extensively filled. It contains large areas of high value habitat and approximately 40 miles of sloughs, river channel and Port waterways. Because the majority of the Estuary is highly scenic with an abundance of wildlife, it offers the urban user the opportunity to experience a natural area with "wildlife reserve" qualities within minutes of a major metropolitan center.

This plan seeks to protect the special natural qualities of the Estuary by promoting low impact passive recreation (wildlife observation, hiking, non-motorized boating) that protects and maintains wildlife and respects property rights. Additionally, in appropriate locations away from the largest area of Group 1 wetlands, regional ballfields for soccer and baseball are proposed. In particular, this plan emphasizes non-motorized boating as the major means for recreational access to the majority of the Estuary. This type of access is compatible with the sensitive resources in the Estuary because it is non-intrusive and tends to occur in lower numbers than other forms of access, due to its physical requirements. User Group committee members unanimously supported promoting non-motorized boating in rural areas of the Estuary and restricting motorized boating in these areas to lower speeds and noise levels so that wakes would not be created and sensitive wildlife would not be disturbed.

This plan also seeks to recognize the regional recreational significance of the Estuary by incorporating it into the Cascadia Marine Trail System. This trail stretches 150 miles from Olympia to Stuart Island (San Juan Island Group) on the Canadian border, and was established in 1993 by the State Legislature under Senate Bill 5667 (Sandie Nelson, Washington Water Trails, personal communication 4/4/95). Critical to the implementation of this trail is the provision of kayak and canoe resting and camping areas approximately every 5 to 8 miles. Therefore, one of the main recreational goals is to establish a canoe/kayak campground somewhere on the western edge of the Estuary adjacent to Puget Sound.

In addition, the Plan limits hiking trails to existing areas within County, City Park ownership and recommends optional "owner leased" trails within the more developed portions of the Estuary (South Ebey Island). All other access programs for the Snohomish Estuary are incorporated by reference into this Plan, including but not limited to the Snohomish River Wetlands Plan (Sharpiro and Associates 1979), Spencer Island Access Plan, Ecology Center Plan, and Everett Public Access Plan. The access trails and facilities proposed by the Shapiro and Associates Plan, however, for Mid-Ebey Island should not be implemented due to the sensitive nature of the resource and the impact that these facilities would have upon this Group 1 wetland complex.